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~~OLD~~ Oil PRODUCTS AND THE DRY ZONE.

Peradeniya, March 15, 1914.

We have been publishing from time to time articles indicating the super-importance vegetable oil is assuming in the markets of the world. The increased cultivation of oil products may be expected to play a large place in future tropical development and perhaps help to solve the problem of what to do with our dry zone. Semi-dry zone it should be called, as a country with 60 inches of rain is not dry except when compared with specially favoured spots like the hill country of Ceylon. The conditions of our dry zone correspond to those prevailing over a vast area of the tropical East African belt and such land has not yet really found its product.

In East Africa coconuts will only thrive on the fringe of the littoral to a distance of about 10 miles inland but in Ceylon, thanks to its insular position whereby the wind of both monsoons blow across the ocean unaffected by continental land breezes, the atmosphere is everywhere sufficiently saline for the requirements of the palm. There are therefore without doubt very great possibilities in our dry zone for coconut cultivation and a drive along the Kurunegala-Chilaw and Kurunegala-Puttalam roads reveals the fact that these possibilities are being realized. The experiments at the Government Experiment Station,

Maha-Iluppalama, in the middle of the Island are illustrating what can be achieved with coconuts in this type of country by the application of some of the principles of Dry Farming in conjunction with a little irrigation Coconut planting is an industy open to the small village landowner as well as the large planter and, speaking generally, it brings in larger net returns, once the trees are in bearing, than paddy.

The oil palm is another product with possibilities for these low and hot expanses. Judging by its native habitat it should require a rainfall of about 70 to 80 inches but in some countries it is being cultivated in localities with less rainfall than this. We are as yet without sufficient data as to its climatic requirements when under cultivation and the returns it gives to enable us to form precise views of its likelihood of success. Palm oil is now being used in the manufacture of margarine; its commercial value is therefore likely to be well maintained. The tree was first introduced into Peradeniya in 1850, and there are seven or eight trees now in the gardens but they bear only a few seeds at this elevation (1,650 ft.) These have been sown and application has been made to West Africa for a further supply of 5,000 with the intention of making a trial of the palm at the new Anuradhapura Experiment Station.

R. N. L.

RUBBER.

THE CULTIVATION OF RUBBER IN BRAZIL.

As a first step towards the establishment of rubber plantations in Brazil, M. O. LABROY, the Director of the Rubber Experiment Station at Para, and M. V. CAYLA have drawn up a lengthy report entitled "Culture et Exploitation du Caoutchouc au Bresil."

The first part of the report contains a review of the statistical position, present and future, based chiefly on the well-known estimates of London authorities, and a brief survey of the sources of wild rubber in general. The authors admit the gravity of the situation and the impossibility of any valorisation scheme for Brazil.

The second part, covering more than 100 pages, deals with Hevea but, except for an account of the methods of collecting and preparing Hard Para, is chiefly a résumé of the methods employed in the East, for the benefit of Brazilian readers. Unfortunately, the practical details with regard to tapping knives, tapping systems, methods of preparation, are for the most part well out of date.

In discussing the different species of Hevea, the authors state there seems to be little probability that the Heveas of the Tapajos, where WICKHAM collected his seeds, could be the result of a cross between *Hevea brasiliensis* and some other species, such as *Hevea collina*, as was once suggested.

The chapter on the physiology of Hevea contains a weird figure of a cross section of the stem, in which the cambium is shown as almost the same thickness as the cortex, and the dead outer bark as thick as the cambium and cortex together. On the Amazon the trees are said to flower twice a year: on the Lower Amazon, the main flowering season is June-July, the second in October-November. The authors refer to two flowering seasons in Ceylon, not realising that these relate to different trees in different regions.

The authors differ from AKERS with regard to the use of the machadinho as a tapping instrument. They point out that a large percentage of the trees in the forests are now so gnarled, or covered with nodules, that the use of any other tool is impossible. In addition, they consider that the renewal of the bark, in the forest, may not proceed with the same rapidity as under plantation conditions, and consequently the adoption of Eastern methods may result in the formation of wounds which will afford an entrance for parasitic fungi. They recommend the retention of the machadinho, but more care in the use of it.

In the account of native methods of tapping, it is stated that in the dry weather the collector puts water or some special anticoagulant in the vessel into which he empties his collecting cups. In the process of coagulation, the paddle is not turned into the smoke until the latex has ceased to drip. The coagulation of a film occupies on the average 30 seconds, about 2 litres of

normal latex being treated per hour. The temperature of the smoke where it impinges on the latex is about 150° F. The balls of rubber lose about 50 per cent. of their weight by drying.

The relative proportions of the different grades of Hevea rubber, according to the harvest of 1912-13, are

Fine Para	...	...	63 %
Entrefine (= second quality)	...	...	10 %
Sernamby (= scrap)	...	...	27 %

In their account of the introduction of Hevea into the East, the authors differ from previous writers in stating that WICKHAM obtained his seeds, "grace à la bienveillance du Gouvernement du Bresil qui fit récolter ces graines par des Indiens sur les seringals de terre ferme, situès dans le Bas-Tapajoz." It would appear that they are confusing the events of 1876 with the previous attempts (1873) to obtain seeds through British consuls in Brazil.

The remaining three parts deal with the Manihots, Castilloa, and Mangabeira. The Manihots are considered at some length, but very little practical information is adduced. In view of the frequent discussions as to the technical names of the various Manihots, the list given by MM. LABROY and CAYLA may be of interest. They cite five rubber yielding species, under the following names :—

Manihot Glaziowii Mull. Arg.	= Manicoba du Ceara
Manihot dichotoma Ule	= Manicoba de Jequie
Manihot heptaphylla Ule	= Manicoba du Sao Francisco
Manihot piauhyensis Ule	= Manicoba de Remanso
Manihot Toledi Lab.	= Manicoba de Villa Nova

T. P.

INTERNATIONAL RUBBER EXHIBITION.

OFFER OF SILVER CUPS TO ESTATE SUPERINTENDENTS OR ASSISTANTS.

In connection with the Rubber Growers' Association Competition No. 1 three cups are offered as under for the exhibits that are placed highest by the Judges.

MR. JOHN MCEWAN'S CUP
for the best exhibit, wherever produced.

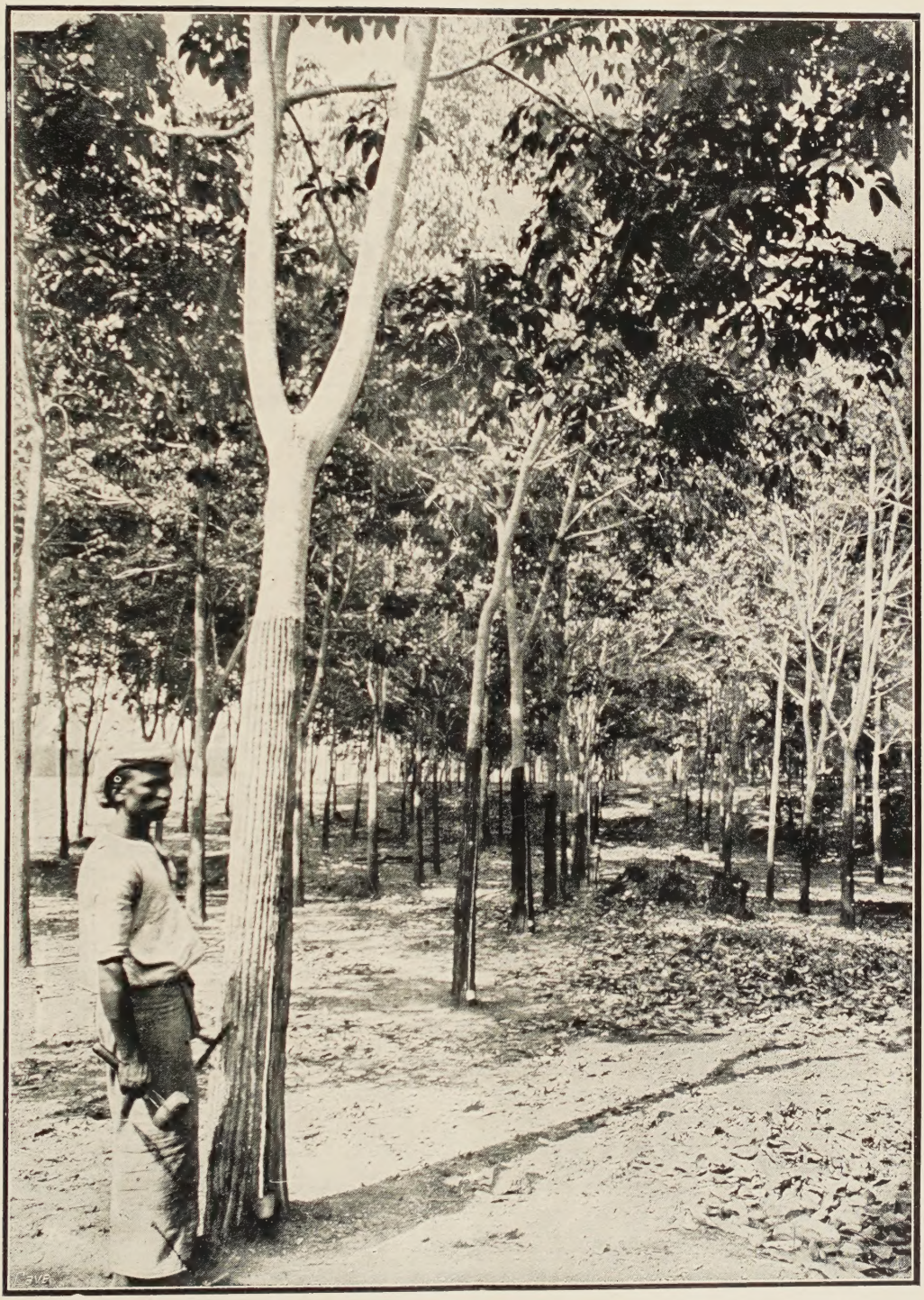
MR. THOS. NORTH CHRISTIE'S CUP
for the best exhibit produced in Ceylon.

MR. E. L. HAMILTON'S CUP
for the best exhibit produced in the F. M. S. or Straits Settlements.

Only one cup will be given to any prize winner and should the highest award be made to an exhibit from Ceylon or Malaysia, MR. CHRISTIE'S and MR. HAMILTON'S Cups, respectively, will go to the next highest from the same producing area. The cups are to be personal awards to the Superintendents or Estate Assistants actually responsible for preparing the successful exhibits.

In the event of any dispute as to the actual responsibility for the work done, the Exhibition Committee will refer the question to a Visiting Agent in the district whose decision shall be final.

No entry is required but it would be advisable for those who are actually responsible for preparing exhibits in Competition No. 1 to have their names sent forward and their responsibility admitted in a definite manner.



TAPPING HEVEA RUBBER, EXPERIMENT STATION, PERADENIYA.

Bamber pricker method.

Part of a series of experiments being carried out at Peradeniya to test the merits of various systems of tapping rubber.

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THE PREPARATION OF PLANTATION RUBBER.

An apology is due to the readers of the TROPICAL AGRICULTURIST and to the author, MR. SIDNEY MORGAN, for this belated notice of his recent book on "The Preparation of Plantation Rubber." The fact is that when the work was first advertised in Ceylon it was impossible to obtain a copy, so great was the demand. On that the author is deservedly to be congratulated. We would urge all rubber planters who have not invested in a copy to obtain one before the edition is exhausted, as it no doubt soon will be.

In rubber cultivation, as in most other industries, the day of the encyclopædia is over, and it is now useless to expect up-to-date information on any branch of the subject in a book which professes to deal with all. Its place must be taken by less pretentious works, each written by a specialist in his own particular branch, as in the case of the book under notice.

One need have no hesitation in stating that from the point of view of the superintendent of a rubber estate the present volume is the best that has been published. It is absolutely indispensable. Its pages abound with explanations of the many difficulties which arise in the daily work of the factory, as well as with instructions and suggestions as to the methods of turning out a finished product of the highest grade. From the collection of the latex to the despatch of the rubber, every detail receives full attention, and the explanations are given in language remarkably free from technical terms. The chapters on defects in crepe, block, and sheet rubber will go far to assist the planter in evading phenomena which at times he is inclined to attribute to "pure cussedness" on the part of his material.

The author opens by stating that it is an easy task to criticise the actions of the pioneer planters of *Hevea brasiliensis*, but he does not always realise how recent the pioneer period is. For example, a full herring bone with three cuts, i.e., up to a height of 3 ft., on half the circumference, was a conservative system in 1908, when most estates were carrying the same system, with six cuts, up to a height of six feet. But the history of the rubber industry is not his strong point. He would perhaps not have been critical of PARKIN'S knowledge of the chemistry of proteids if he had known that PARKIN'S work was published in 1899, not, as he states, in 1910. There are several points, obvious to anyone who reads the original bulletin, which may afford an explanation of some of PARKIN'S apparent mistakes. One is that he employed single incision methods of tapping, and therefore his latex may not have been identical in composition with ordinary estate latex. With regard to the acetic acid error there is one circumstance which has not been previously brought forward. PARKIN left Ceylon after his manuscript had been placed in the hands of the printer, and he did not correct the proofs. In the original bulletin, the quantity of acetic acid is given as 0·95 in the table, but in the text immediately below it is stated to be 0·09. Obviously one set of numbers was incorrect, and PARKIN wrote to Ceylon, correcting the error. For some

unfathomable reason, the correction was hidden, together with a four-page account of tests of PARKIN's specimens by MM. MICHELIN & CIE, in the *Annals of Peradeniya*. But PARKIN corrected the text, making the figures there identical with those in the table. As the quantity given in the table is ten times too great, the natural suggestion is that PARKIN corrected the wrong set of figures.

The use of permanganate of potash for disinfecting rubber is deprecated on the ground that traces of that substance have an injurious effect on vulcanisation. It should have been stated in addition that, in any strength in which it is a disinfectant, it turns rubber tacky. It is rather surprising to find no reference to FICKENDEY's experiments on tackiness. The author will be interested to learn that all his facts on "spot" diseases of rubber were known in Ceylon by the end of 1911.

On page 65, the author's method of calculating the amount of acid required, admittedly a rough one, brings the example given at the bottom of the page, nearly 25 per cent. in error. His difficulty in understanding why the use of formalin as a means of retarding coagulation is not more popular might be solved by a reference to his principals. One only wishes that the statement that the half coconut shell, as a collecting cup, has disappeared applied equally to Ceylon. His last paragraph on p. 33 is based on a misreading.

The author's dicta on botanical questions are not always well founded, though, generally speaking, he agrees with the more modern ideas on planting and tapping. But we regret that he fails to see any serious objection to the basal V., or to top tapping. On the question of fungicides he makes the sweeping statement that "there can be no legitimate excuse for the use of spraying mixtures containing copper salts on trees in bearing, since there are other mixtures equally efficacious and quite harmless." Would that it were true! It has of course been known for a long time that copper salts cause tackiness in rubber, and in using Bordeaux mixture, a copper fungicide, there is the danger that the copper compounds may be washed into the latex in wet weather. The equally efficacious mixture to which the author refers is lime sulphur wash, which has just been made the subject of an American boom. But a perusal of the technical journals will show that proved cases are being steadily accumulated, in which the lime sulphur is of no value, and the boom appears likely to subside as rapidly as it rose. It has not previously been claimed that lime sulphur mixture is as efficacious as Bordeaux mixture. What is claimed is that it can be used in cases where Bordeaux mixture causes injury. Is Hevea a case in point? Can lime sulphur mixture be substituted for Bordeaux mixture, with only a slight loss of efficiency? Bordeaux mixture has been recommended against "Pink disease" and "Canker" (*Phytophthora Faberi*). As regards *Phytophthora* it has been demonstrated that Lime sulphur mixture is useless in cases of Potato disease caused by *Phytophthora infestans*, and it has even been proved that the constituents of the mixture are not toxic to that fungus. We may grant that the latter point should be proved for *Phytophthora Faberi* also, but on the available facts it must be admitted that mycologists have good ground for recommending Bordeaux mixture. Both sides of this question have

hitherto been argued *a priori*; there is no proof that the copper salts of Bordeaux mixture cause tackiness. The author would confer yet another obligation on the industry if he would carry out an experiment in spraying with Bordeaux mixture and note the effect on the rubber subsequently collected.

The points on which we should venture to differ from the author are chiefly botanical. The book would have been better balanced by the omission of the first two and the greater part of the last two chapters. But the value of the book depends on the intermediate chapters, and, as has already been indicated, it should be purchased and studied by every rubber planter.

T. P.

RUBBER INDUSTRY IN UGANDA.

Some interesting particulars as to the progress of the rubber industry in Uganda are contained in a Blue Book just issued. It is stated that the areas under the more important products are being greatly extended, and the number of European plantations is steadily increasing. The price of agricultural land has risen rapidly. Cotton is by far the most important product at present, Uganda coming second in the list of cotton-producing countries in Africa, but coffee, cacao and rubber are being widely planted, and experiments are in progress with tea and tobacco. The Agricultural Department is giving the closest attention to the education of the native in sound methods of agriculture with most promising results. There are three Government plantations in different parts of the country used as centres for instruction and for experiment in crops suitable to the locality.—FINANCIAL TIMES.

THE RUBBER MARKET.

The market in rubber, the commodity, has been good. The offerings at the next auctions are again likely to prove much below the figures at one time published. The demand for rubber round present prices is very keen. Considerable forward business has been passing. A general impression prevails that the commodity is going better. This feeling is evidenced by big manufacturing concerns making overtures direct to leading companies for their produce at prices above current market rates. A feature of the less auction sales was the reduction in the big premium which smoked sheet has so long commanded above crêpe. The relative variation of the prices of these two descriptions merely reflects the varying demand. The present exigent demand for rubber is purely the result of the stimulus of recent low prices. Any organised attempt to crib supplies and crab the market, as unwisely advocated in some quarters, would react prejudicially on the future of the industry. Rubber shares are on a far sounder permanent investment basis with rubber at 2*s*. 6*d*. per lb. than at 3*s*. per lb. A continuance of the present prices will yield magnificent profits to sound companies during 1914, and further stimulate manufacturing activity. We hope leading companies will sell forward freely round 2*s*. 6*d*. Large scale manufacturers are not going to sink large sums of capital in

new departures unless certain of their supplies of the raw material at a price likely to yield them a fair manufacturing profit on their capital. The share market has been active and strong. The 3 per cent. Bank rate revolutionises the position of the first class dividend payers, which should steadily appreciate in value.—INVESTORS' CHRONICLE.

THE RUBBER CRISIS.

J. TILMAND & E. ZIMMERMANN.

M. TILMAND summarises various views brought forward by journals, reviews and other authorities on the present rubber crisis and its possible solutions. Protection is of particular importance in its relation to wild rubber.

BRAZIL.

A reduction in price does not affect the production till the following year. The quantity harvested depends on the credit of the "aviadores" and the means which they possess of sending workmen into the forest. They have suffered considerably this year owing to the fall in prices, and it seems doubtful if they will be in a position to finance the usual number of workmen next year.

The following measures have been adopted for improving the situation: Reduction of export duties by half; suppression of all duties and taxes on plantation rubber; construction of railroad; to reduce cost of transports; construction of refining station, so that only first quantity products are exported.

BELGIAN CONGO.

The export duty of 1·75 francs per kilo ($7\frac{1}{2}d$ per lb.) has been removed. It is hoped that recourse to bounties will be avoided by the following means :— Reduction of freight charges by rail and sea ; more careful collection of the tax, which is at present too frequently evaded; increasing the tax on underselling pedlars.

FRENCH EQUATORIAL AFRICA.

Export duties have been lowered from 0·60 franc to 0·30 franc per kilo ($2\frac{1}{4}d$ to $1\frac{1}{2}d$ per lb.). Including the reduction on the cost of transport by the Belgian Congo railway and the steamship companies, the total reduction on rubber in the French possessions amount to 0·70 franc per kilo ($3d$ per lb.).

GERMAN COLONIES.

In East Africa the most important question is the organization of labour. The period of indenture should be increased from one to three years, in order to reduce the loss of time and money to the coolies, the owners and the colony. According to DR. ZIMMERMANN, the cost of production can be lowered by increasing the output of the workers and the purity of the product. An expert cooly should easily harvest a quantity of latex equivalent to 900 grammes of washed rubber ; at a market price of 3·5 marks (1*s*. 6*d*. per lb.) this will give a profit of £ 30 per ton. The reduction granted by the steamship companies has lowered the freight from 90 marks (£ 4. 10*s*) to 65 marks (£ 3. 5*s*.) per ton. The reductions by the railway companies amount to 50 per cent. Unfortunately the total reduction represent only about $\frac{1}{2}d$ per lb. KAMERUN asks for the abolition of the export duty of $8\frac{3}{4}d$ per lb. —MONTHLY BULLETIN.

LONDON RUBBER EXHIBITION.

HIS MAJESTY THE KING having given his approval, PRINCE ARTHUR OF CONNAUGHT will open the above-named Exhibition on the 24th June next. The RIGHT HON. LEWIS HARCOURT, M.P., Secretary of State for the Colonies, will also be present and will speak. Thirty-five British and Foreign Governments will be exhibiting, as well as many important Associations and Companies; also manufacturers and others connected with the industries that come within the scope of the Exhibition.

BRAZIL AND STANDARDIZATION.

We publish some comments made in the official journal of the Superintendencia da Defesa da Borracha prior to the issue of the Report of the Rubber Growers' Association, from which it is clear that Brazilian interests are anxious to gain a reputation for grades other than fine hard, presumably by the issue of certificates guaranteeing quality. The suppression of the Superintendencia da Defesa da Borracha by the new Minister of Agriculture, as announced in a recent issue, may, of course, affect the validity of the proposals made :—

Meanwhile really superior hard rubbers might be selling not only below "fine hard," but on a level with plantation or even lower, seeing that in the East a scheme of standardization is already under consideration of the Rubber Growers' Association, whilst here nothing practical has been done.

No satisfactory market can ever be established on mere samples. For free buying it is necessary that not only should the quantity offered be large enough for manufacturing purposes, but that quality should in some way be guaranteed.

To ensure that the first step should be to start experimental stations big enough for practical testing in every sense.

As, however, it would take some time to bring such plantations to maturity, and the necessity of thoroughly testing the commercial and technical value of rubbers offered for sale is urgent, Government might periodically purchase representative lots of the different new brands offering at Para, Manaos and elsewhere, and by selling same, accompanied by the respective vulcanized samples, at London and New York, ascertain the real price they are likely to obtain in those markets.

This would necessarily entail the acquisition of testing and vulcanizing plants for different districts. . . . .

In the same number of the above journal (31st October, 1913, p. 251) some interesting figures are given regarding quantity and value of Brazilian rubber. It is often suggested that only "fine hard" need be considered, i.e., in competition with plantation, and that this means only about 15,000 or 16,000 tons. The following figures in this connection are interesting :—

Hard fine, Brazilian origin, 1912	...	...	19,095
Soft fine, do do 1912	...	...	3,153
Hevea scrap or Sernamby	...	...	8,514
Total Brazil	...	...	30,762
Peru and Bolivia, about	...	...	4,800
			35,562

The Brazilian journal further points out that on the 6th September, in London, "fine hard" was quoted at 3*s.* 7*d.*, 3*s.* 3*d.* for soft fine. 3*s.* 3½*d.* for entrefine, and 2*s.* 1½*d.* for Sernamby (scrap), while the best plantation smoked was selling at 2*s.* 7*d.*—India-Rubber Journal.

NEW METHOD OF TAPPING MANIHOT.

M. Migdalsky, Director of the Prinz Heino Plantation, Morogoro, E. Africa, has discovered a method of diminishing the expense of tapping Manihot trees. Lewa's method of rolling into balls involves considerable hand-labour, and has been modi fied as follows: a piece of cloth about 28 inches long and 4 inches broad is soaked with a solution of vinegar and applied to the incision in the bark; the cloth is then drawn upwards in close contact with the tree. The latex adheres to the cloth and is coagulated in the form of a small pellicle, which is easily detached.

This method has distinct advantages.

(1) Fewer incisions are required compared with the older method and the trees can be tapped more frequently.

(2) The rubber is pure and can be cleaned by hand, one workman being able to clean 60 lb. per day.

(3) The operator does not require the same skill as with the older method.

(4) The yield of the labour is considerably increased. Unskilled workmen have produced in one day the following quantities:—

(a) by the old method (in balls) . ... 8½ oz.
(c) by the new method ... ... 28 ..

—Monthly Bulletin.

MANGOES AND COCONUTS IN CEYLON

Mr. C. L. H. Bandaranayake, Veyangoda, writes to the Secretary of the Society as follows:—

You would be glad to know that the grafted mango trees purchased from you by me in 1909 are all in blossom and some have fruit on them. I trust they would not be affected by the drought we are having just now; if not I am sure I will have a good quantity of fruit. I may also mention the fact that 4 of my young coconut plants planted in this land have come into bearing in their fifth year. I am no more troubled with black beetles now.

SORGHUM IN MADRAS.

Twenty-two acres were sown down with this crop this year and have given an average acre-yield of 433 lb. of grain and 1, 394 lb. of straw as against last year's yield of 420 lb. of grain and 1, 920 lb. of straw. The best yield was obtained from a 25-cent plot grown from seed obtained from Pulimaddi, the yield calculated per acre being 920 lb. grain and 2, 200 lb. straw.—Rep. of the Dept. of Agric., Madras Presidency.

CACAO.

The January number of the Philippine Agricultural Review is specially devoted to Cacao. We extract from it the following :

CRIOLLO VARIETY.

Of this type there are three or four recognised forms, such as the Venezuela, Nicaragua, and Trinidad. This type has a long, thin-shelled, pointed pod, usually with more or less constriction near the base. The "bottle-neck" shape is not constant and even on the same tree some Criollo fruits will be found without the pinched-in base. The ridges, or angles, are usually more pronounced and sharper than in the case of the Forastero. The Typical Criollo seed is pale-yellowish white or pinkish yellow. The colour of the ripe pod is usually yellow but may in some forms take on a reddish or pale-purplish tinge, especially upon the tops of the ridges. The aroma and flavour of the cured seed are excelled only by the Pentagona.

FORASTERO VARIETY.

This is by far the commonest variety of cacao throughout the world. In its many forms it constitutes probably 80 per cent. of the total output. The pod is characterised by a certain smooth appearance, of more or less cylindrical shape, usually with an abruptly tapering point and a square base. The colour is almost always purple or dark red, with just a tinge of yellow at maturity between the ridges. The seed is of good size, purple or, at least, pinkish, and in some forms of almost as good quality as the Criollo, while the productiveness is unquestionably better. The seed is usually somewhat flatter than that of the Criollo type.

PROPAGATION.

Cacao propagation may be considered under two heads : (a) Seedage, including the propagation of the seedlings and their transfer to the cacao plantation ; and (b) graftage, including buddage, inarching, and all modes of grafting.

When the seedling plants have attained a diameter of 20 to 25 millimeters, and a height of 15 to 20 centimeters above ground, and are in vigorous growing condition, they may be budded. Budding should never be performed on rainy days, for if water enters the bud it will be destroyed.

The following conditons are necessary in order that the budding may be successful :—

1. The plants must be in condition for budding, i.e., there must be a good flow of sap so that the bark separates readily from the wood.

2. The stock at the point of insertion of the bud should be of approximately the same age as the bud wood.

3. A good budding knife, absolutely clean of all impurities, with an edge sufficiently keen to shave the hair on one's fore-arm.

4. Suitable bud wood. Failure to give sufficient importance to this matter may have been one of the chief reasons for failure by former experimenters with shield or T budding. Bud wood should be selected from the current or last year's growth that has been of slow formation, and from which the leaves have dropped. Sappy wood or old black twigs should be rejected, at least by the inexperienced budder, for the reason that such bud wood is very brittle and splits easily in the cutting of the bud. Also, buds with the petiole still attached should never be inserted because fungi enter the bud from the petiole and destroy it. Desirable bud wood with the leaves still attached may be made available for budding in the course of two or three weeks by cutting off the leaf blades. The petioles then drop within a short time and the twig may be cut for bud wood as soon as the leaf scare is *well healed*.

5. The bud wood should never be permitted to dry out from exposure to the air and sun.

6. The bud should be inserted immediately after being cut, and the bud tied at once.

7. No water or foreign matter should be allowed to enter the bud incision.

8. The bud should be cut without any break or tear in the tissues.

9. Waxed tape should be used for tying and the entire incision covered.

PREPARATION OF GRAFTING WAX AND TAPE.

Wax cloth for tying is prepared as follows : Beeswax, 8 kilograms; resin, 2 kilograms.

Place the ingredients in an iron pot and melt over a slow fire.

The best material for grafting tape is cheap cotton cloth that tears easily. Rip the cloth into strips 15 to 20 centimeters wide, and wind the strips of cloth on stout iron wire until the roll is 5 centimeters in diameter ; if thicker, the wax penetrates with difficulty to the centre. To prevent the cloth from unrolling, tie strings around the end of the roll. The weight of the wire will sink the rolls in the mixture while the cloth absorbs the wax. If the cloth is rolled on wooden sticks the rolls must be weighted down. Keep the rolls in the melted wax for about fifteen minutes to saturate the cloth. Do not permit the mixture to boil else the cloth may be burned.

When required for use unroll the cloth and tear it into strips about 2 centimeters wide.

The budding operations should be performed in the following order : First make a verticle incision in the stock, about 15 to 20 centimeters above the ground ; then, at the lower end of this incision, make a horizontal cut so that the resulting wound resembles an inverted T ; then, in order to facilitate the insertion of the bud, make a sloping cut upward, below the horizontal cut and also lift the bark by passing the point of the blade under the bark upward, along the vertical incision, loosening the bark sufficiently to allow the bud to slip into place easily ; now cut a bud not less than 4 centimeters long, by passing the knife *diagonally* under the bud, taking special care that it is not cut too thin and that the tissues do not split or tear which is liable to occur if the knife is dull or if it is held at too great an angle to the bud stick ;

as a further precaution it is well to hold the tip end of the bud stick toward the body in the act of cutting the bud ; now insert the bud and tie firmly, without strangling, with waxed tape, beginning at the point of insertion and covering the entire incision so that no water can enter.

Fourteen to eighteen days after the buds are inserted, the buds should be examined, and where they have taken the tape should be unwrapped to below the leaf scar and the stocks should be "lopped" about 10 centimeters above the bud. This is done by cutting through the stock about one-half to two-thirds with a knife or pruning saw and bending the tops over. The budded plants should hereafter be examined once every ten days, and all wild sprouts on the stock rubbed off. This work is most important, for if it is not attended to the stock sprouts rapidly gain the upper hand at the expense of the bud, which frequently under such circumstances fails to grow at all. When the bud has made a growth of 30 or more centimeters, according to the size of the stock, and the wood is well ripened, cut off the stock immediately above the bud union. *Paint the wound carefully with white lead or some other oil paint in order to exclude borers and fungi.* If the buds fail to make straight upright growths they should be staked and tied ; split bamboo stakes are very serviceable for this purpose.

Large seedlings may, of course, be top-worked by heading them back and budding the young sprouts.

SHADE FOR CACAO.

There has been and still is a great deal of discussion upon the question of shade in cacao plantations. The tendency now seems to be in all countries, however, to do away with the old heavy shade and use the nurse trees *only for the young plants.* Cacao roots cannot endure "sun baking" nor can the tender leaf flushes endure wind whipping, but, on the other hand, given a suitable cover crop for blanketing the soil surface and a moderate amount of protection from wind, there is, at least in the writer's (MR. O. W. BARRETT) opinion, no question whatever as to the injuriousness of dense shade. In the Philippines nothing larger than madre de cacao, or cacahuate (*Gliricidia maculata*), should be used for the young trees, while, of course, any quick-growing strong-wooded plant, such as the mango, can be used to form wind-breaks.

RAINFALL FOR FEBRUARY.

Place	1914	1913	Place	1914	1913
	in.	in.		in.	in.
Colombo	1·56	2·26	Kurunegala	·07	·72
Kandy	·52	1·92	Batticaloa	6·31	1·82
Galle	·29	3·85	Badulla	1·03	6·30
Jaffna	0	·52	Ratnapura	7·95	1·68
Anuradhapura	·27	2·61	Nuwara Eliya	·50	2·44

COCONUTS.

THE DRYING OF COPRA.

A recent official report contains an account of a kiln employed in the British Solomon Islands for drying copra It consists of a house of corrugated galvanised iron with an enclosed furnace on the ground. The flues, constructed of fire bricks and sheet iron, extend beneath the whole area of the floor, and there is an external shaft of sufficient height to ensure a good draught. A system of trays composed of angle iron and woven wire, running on wheels is arranged one above the other within the house. As much as from one to two tons of copra can be treated within the twenty-four hours. The quantity, of course, depends entirely upon the size of the structure. The husks of the coconuts supply fuel for the furnace, and are better so employed than in an attempt to turn them to commercial use by the manufacture of coir fibre.

As the kiln-dried copra is worth from £1 to £2 per ton more than the smoke-dried at the place of shipment, it is, says the BRITISH TRADE JOURNAL, obviously advantageous to go to the expense of a kiln when large quantities of copra are handled, in spite of the high initial expense. It is probable that in a few years the use of the kiln will almost entirely supersede the operation of drying over an open fire.—WEST INDIA COMMITTEE CIRCULAR.

Disc-harrowing a 7-year-old Coconut Plantation at Peradeniya Experiment Station, keeping it free from weeds and preserving the moisture.

THE INCREASING VALUE OF COPRA.

It is of great interest to note the rapid advance in the price of copra during recent years. Less than ten years ago, the market was over-supplied, yet to-day there is a shortage and prices are very high. Average copra used to realise £12 per ton; £32 per ton is now-a-days considered a low figure. Similarly coconut oil, the most valuable constituent of copra, has advanced from £18 to £48 per ton.

It is not probable that we have even yet reached the maximum price for these valuable commodities, rather are they indications that prices will advance and there is little danger of a material decrease for some years to come.

Undoubtedly this satisfactory growth in the copra trade was mainly determined by the researches of European chemists, who discovered methods of purifying crude coconut oil and made it possible for manufacturers to supply a tasteless and inodorous product. The objection to the use of coconut oil as an edible product, before this discovery, had been its great tendency to be rancid and of objectionable odour and flavour. During the drying of copra there is always present an excellent medium for the growth of bacteria, as the nut contains a considerable percentage of proteins. These bodies in the presence of moisture form an almost ideal food for bacteria, those minute plants which are always falling gently through land atmospheres in a never-ending rain. Only on the high seas are we free from these organisms and even there only to a comparative degree. This richly fertile seed-bed is thus quickly strewn with the falling bacteria and as it is maintained at temperatures favourable to their growth, the organisms multiply very rapidly

One bacterium divided into two new plants every thirty minutes gives rise to upwards of a million organisms in 10 hours. From the copra the bacteria find their way into the oil and speedily cause rancidity and develop a disagreeable odour and taste.

It is pleasant to record the fact that chemists have thus stimulated tropical trade in this direction. Sometimes their labours have had an opposite effect, as in the case of the synthesis of indigo and as may be the case in the synthesis of rubber; but progress of any kind will always claim its victims and scientific progress is no exception to the rule.

Edible coconut oil has thus been established within recent years. Since the oil is a solid fat in temperate climates, it now has a very large sale under such names as nut lard, nut margarine, nut butter, etc. Three years ago margarines were mainly composed of animal fats. It is now hardly exaggeration to state that they are for the most part composed of coconut oil. Nut lard, consisting almost wholly of coconut oil, has gone up by leaps and bounds in the public estimation. The large numbers of nut butters sold in vegetarian restaurants and by large houses which manufacture vegetarian products under the names of walnut, peanut, almond butters, etc., contain coconut oil as a very substantial basis.

Mixtures of coconut oil, animal fats, milk and flavouring essences are made into compounds so nearly resembling butter that the Public Analyst has no little difficulty in distinguishing between the fictitious and the genuine article.

Coconut oil has also replaced cacao butter to no inconsiderable extent in the manufacture of chocolate.

The new odourless fat also enters into the composition of many ointments, pomades, etc., made up by the wholesale druggists. Formerly it could not have been used for such purposes on account of its liability to become rancid.

At the same time coconut oil always has been and probably always will be an invaluable fat to the soap boiler. Its fatty glycerides give rise to soaps that lather very freely, even making possible a so-called marine soap, which will lather in sea water. The shortage caused by its use as an edible has compelled soap makers to search for other fats and has given a great stimulus to the whole trade in fats and oils, more particularly such fats as are contained in the fruits of various palms.

It is hardly necessary to point out that millions of nuts are still desiccated, ground and sold for the confectionery trade. When it is also considered that the coconut is a stand bye for the vast numbers of tropical natives whose wants must be satisfied before there can be an export and the many and rapidly increasing uses to which exported copra is being applied, there can be little fear of over production of this article for many years to come.
—H. S. S. in Trinidad and Tobago Bulletin No. 76.

RICE.

PADDY IN MADRAS.

SEEDING PADDY.

Experiments were continued to determine the best seed-rate for seed beds and the best distance apart to transplant. Really this ought to be worked out by each man for his own land. But generally if the land be treated fairly singles about 9 inches apart are as a rule most profitable. The fact remains, however, that except in the few cases in which doubles or trebles are planted for definite experimental reasons every paddy crop which is transplanted on our farms is transplanted singly. The average yield of main crop paddy over the whole wet area at Samalkota this year was 3,586 lb. of grain, whilst the maximum yield found in any of the crop-cutting experiments on the ryots' land in the Godavari was 2,900 lb. of grain per acre or 1,302 M.Ms. as compared to 1,009 M.Ms. At Pular the average yield of paddy per acre in the main season over the whole farm was 2,119 lb. or 963 M.Ms. as compared with 1,872 lb. or 851 M. Ms., the maximum found in the local crop cutting experiments. These results are, of course, also in part attributable to better manuring—especially green manuring.

GREEN MANURING OF PADDY.

It is round the action of green manure crops that most interest at present centres. In individual cases large increases in yield have resulted from growing and ploughing in green manure crops and there is no doubt that this practice has improved very considerably the fertility of the land at Palur and Samalkota. Also it has proved very profitable in the Periyar tract. Yet very little is known about the method in which the ploughing in of such crops reacts upon the soil of paddy land. For the last few years MR. HARRISON has been engaged on a series of carefully designed experiments to determine the processes of fermentation which take place in a paddy field and to find some clue to the factors controlling the growth of the crop. His researches were leading him to the conclusion "that drainage or at least some movement of the soil-water is essential for paddy cultivation and especially so when bulky organic manures are applied." Among his undrained plots paddy fared much worse in those that had received green manure than in those in which the soil was left unmanured. In the course of the year a farm was opened at Manganallur in the midst of very fine heavy soil of Tanjore delta. Sunn hemp was grown for green manure and treated in the method found to succeed at Palur and in Madura and the paddy was transplanted. It failed hopelessly. In the course of the green manuring the land had been flooded and dried, which it was found in this fine soil was sufficient to stop drainage. This result corroborates the results of MR. HARRISON'S experiments that if there is no drainage a green manure crop unless very carefully managed is likely to have a deleterious, instead of a beneficial, effect. On the other hand there is little doubt but that the addition of bulky organic manures will in

time improve the drainage of such land and incidentally the fertility. Experiments are being designed at Manganallur to discover how best to effect this. I look upon this failure at Manganallur and MR. HARRISON'S work as two of the most important and instructive local agricultural events of the year.

SAMALKOTA AGRICULTURAL STATION PADDY.

This crop did very well this year and most of it lodged owing to the weight of the ears. The average acre-yield for the whole area under this crop for the maincrop season was 3,586 lb. grain and 5,278 lb. straw as against 2,352 lb. grain last year. Rasangi on an area of 3·77 acres, Konamani on 15·66 acres and Ratnachudi on 2·24 acres gave average acre-yields of 4,459 lb. grain and 5,450 lb. straw, 3,498 lb. grain and 5,465 lb. straw, and 2,793 lb. grain and 3,938 lb. straw, respectively, the highest yield of grain, 4,960 lb. per acre being obtained from a 20-cent plot of Rasangi in Field No. 10.—REP. OF THE DEP. OF AGRIC., MADRAS PRESIDENCY.

THE CULTIVATION OF UPLAND OR HILL RICE.

As already pointed out, the upland and lowland forms of cultivated rice tend to merge into each other, and no sharp line of distinction can be drawn between them. The extreme forms of each kind are, however, quite distinct so far as cultural requirements are concerned, whilst standing surface water is essential to the development of typical lowland rice it is unnecessary and even harmful to the extreme forms of upland rice. The cultivation of the latter is confined chiefly to hilly districts which cannot be artificially irrigated, and which in consequence are unsuited to lowland rice. Comparatively little cultivation is required, transplanting being unnecessary, and the natural rainfall affords the requisite amount of moisture.

Usually only a short period is required to mature the crop, the exact length of time necessary depending on the particular variety of rice grown and, to a large extent, on the duration of the rainy season.

The crop is therefore one which can be grown as a catch-crop on new plantations of perennial plants, or in rotation with other crops, and is worthy of more attention than it at present receives, especially in districts where a local demand for rice exists.

The success of the crop depends chiefly on the thorough preparation of the land, as this not only destroys weeds, but produces a fine surface tilth which serves as a suitable seed-bed for the grain and also tends to check the evaporation of soil-moisture. Soils of a lighter character than those required by lowland rice are preferable, and if it be virgin land a shallow ploughing is the only preparation required, but if the land has been cropped for several years deeper ploughing is essential in order to provide a more extensive rooting medium. As the seed is sown on the field and not on a seed-bed, it is important that grain of high germinative power should be selected for sowing otherwise the stand will be thin and the crop proportionately scanty. For this reason it is advisable to test the vitality of the grain intended for planting,

and to regulate the thickness of the sowing according as the percentage of germinated seeds is high or low.

The cultivation of upland rice is carried on by the natives in nearly all rice-growing countries, but on a much smaller scale than in the case of lowland rice. Forest clearings are usually planted with this crop and abandoned after the first harvest, but as this is a wasteful system, destructive to the forests, it is now discouraged in most countries, and in some cases it is forbidden. The native methods of cultivation as practised in the Philippine Islands are described in the Philippine Agricultural Review (1910, 3,632), and these may be taken as typical of the general practice. Two methods are practised in the Philippines known locally as the "caingin" and the "sabog" methods. The caingin method consists in clearing a portion of the forest of shrubs and small trees and burning them on the ground, prior to the rainy season, leaving the stumps of larger trees standing. The area thus cleared is planted at the commencement of the rainy season. The planting holes are made by men who place themselves side by side about 3 feet apart and walk backwards, and by means of pointed sticks 1 to 1½ inch in diameter, make shallow holes in the ground, from 4 to 8 in. apart, to receive the seed. The seed is sown by women or children, who walk facing the men and place from 4 to 20 grains in each hole. From 4 to 7 grains, in holes of 6 in. apart, usually suffice. The right hand is used for handling the grain, and with the left the holes are filled in with soil. In some cases the filling in is done by a third party of workers who follow the sowers and cover the seed by brushing soil into the holes.

By the sabog method the ground is ploughed once during the dry season and again at the commencement of the rainy season, after which it is harrowed and the seed sown broadcast. A light harrowing is given after sowing, in order to cover the seed. Occasionally the seed is sown in drills instead of broadcast, in which case the sower follows the plough and places from 5 to 20 grains at intervals of from 4 to 8 in. along the furrow, covering them with soil by the foot, or the seed may be evenly distributed along the furrows instead of in "hills," and covered by lightly harrowing the soil.

The rate of seeding is about 58 lb. per acre. The average yield is usually not more than half that from transplanted lowland rice, but on virgin lands, if the rains are favourable, heavier yields are frequently obtained.

During the years 1909 and 1910 the Philippine Islands Bureau of Agriculture made trials of some 458 native varieties of upland rice. Of this number only twenty-five are recommended for general planting. These are non-bearded kinds with white, non-glutinous grains; the length of time they required to attain maturity varied from 126 to 141 days, and the yield from 2,378 to 4,064 lb. per acre. In these trials the average yield was higher than for lowland varieties, but the trials covered a period of only two years, and both seasons were favourable to the crops :—

Upland rice has been successfully grown in the Logan district of Queensland, with a rainfall of between 20 and 30 in. during the growing season. The variety found best adapted to this locality is known as "White Java." This grows to a height of from 4 to 6 ft., and produces good crops of

fairly plump grain, of good length and quality. The land is prepared as for an ordinary cereal crop, by ploughing and harrowing, to produce a fine surface tilth. The method of planting found to give the best results consists in sowing with an automatic seeder, in drills 2ft. 6in. to 3ft. apart, with a spacing of 10 to 12in. in the rows. The method requires 35 to 40 lb. of seed per acre as against about 60 lb. for broadcast sowing. The wide spacing between the rows permits of the use of the hoe or cultivator to remove weeds during the early stages of growth ; it also encourages "tillering," and as many as thirty or forty heads of grain have been obtained from a single seed. —IMP. INST. BULL.

PADDY.

CULTIVATION AND PREPARATION OF RICE.

TO THE EDITOR OF THE TROPICAL AGRICULTURIST.

DEAR SIR,

In an article on the cultivation and preparation of rice published in the last number of the IMPERIAL INSTITUTE BULLETIN the following points have been brought out :—

(1) Complete withdrawal of the water prior to the ripening period produces the conditions most favourable to the proper maturing of the crop.

(2) In Java soils of only average fertility is chosen for seed-bed, as experience has shown that seedlings from rich beds receive a check, and grow less satisfactorily after being transplanted in less fertile soils.

(3) In such beds (i. e. "dry" seedbeds) seedlings may remain for as long as a hundred days and can then be transplanted without harm.

(4) It has been found that tillering is greatly encouraged and the yield thereby largely increased by keeping the soil saturated with water but not allowing sufficient to stand on the surface until after the plants have fully tillered.

I shall be glad to have an expression of opinion from you on these points.

Yours faithfully,

W. MOLEGODE.

Katugastota,
28. 2. 14.

SEEDS AND PLANTS FOR MEMBERS.

No order form is being issued as hitherto, but the next April number of the *Tropical Agriculturist* will notify plants and seeds available.

TOBACCO.

TOBACCO PROSPECTS.

"Financial Times" (30 Jan.), in a lengthy article dealing with tobacco trade prosperity, states high yield now being returned upon capital invested exceeds all previous ratios. This is due to high degree of efficiency attained in organisation of industry, while market supply now regulated well in accordance with requirements. All producing companies are doing well just now. Their prosperity seems likely to improve during next 12 months in view of high prices ruling, while increased supplies will be available in those centres of production showing shortage last year.—Investors' Chronicle.

TOBACCO WAREHOUSE MANAGEMENT.

T. E. ELGIN.

The tobacco plant thrives in many parts of the world, and tobacco has become one of the principal exports of some of the great agricultural countries.

Revenue collected as excise and import duties enrich the treasuries of many nations, while the tobacco consuming public purchases each year approximately 2,000,000,000 lb. of this commodity. Tobacco is a source of income to many farmers in South Africa, and the area under cultivation is being extended. In South Africa, however, we produce only 1 lb. out of every 145 lb. of the world production of tobacco. Imports of leaf and manufactured tobacco into South Africa show but little decrease each year, which indicates that the consumption of the better grades of leaf in this country is increasing as rapidly as the production.

It is not necessary to mention in this article the methods used in the proper cultivation, harvesting, and curing of tobacco, as bulletins have already been published by the Tobacco and Cotton Division on this subject. We will, therefore, consider only the handling of the crop from the time it is taken to the warehouse until it is delivered to the manufacturer.

The first question to consider is that of finance.

If the business is conducted by a private company, it is controlled according to the ideas of the company's directors. When a warehouse is controlled by a co-operative society in this country certain laws passed by Parliament regarding the finances of such societies must be observed. Under certain conditions, co-operative societies can obtain loans from the Land Bank or perhaps from other banks, so that advance payments can be made to the farmers when their tobacco is delivered to the warehouse.

BUILDINGS.

Next comes the question of suitable buildings. A warehouse may consist of two or three floors, but in South Africa one floor would be sufficient in most cases for the handling of leaf. The size of the buildings should be in

proportion to the quantity of tobacco to be handled during a season of good business. The material may be wood and corrugated iron, but in hot dry climates brick walls are better. There should be windows sufficient to give light and ventilation. Large buildings should have sky-lights so as to distribute an even light to all parts of the building. The floor of the warehouse should be high enough for the air to circulate underneath, which will prevent the tobacco from absorbing moisture from the ground. In large warehouses a road for wagons to pass into the building is desirable. When wagons are off-loaded outside the building there should be a lean-to roof sufficient to protect the loads from rain while the wagon is being unloaded.

The building may be one large room, or if conditions require it the building should be divided into compartments suitable for the handling of tobacco in its different stages. Offices should be provided in or near the main building.

EQUIPMENT.

The weighing machines should be situated on or near the off-loading platform and should be mounted on solid foundations with the weighing platform level with the floor. Portable weighing machines on wheels are also needed so that they could be moved about and used for weighing bales and small lots of tobacco. All weighing machines should have two beams: one for balancing tare, while the other gives the net weight of the tobacco.

In modern warehouse "dump" trucks and baskets suitable for handling bales, are used for moving tobacco to and from different parts of the warehouse.

When tobacco is being handled in dry weather, steam is necessary for moistening it so that the leaves will not break in handling. The steaming plant consists of boilers, pumps, water-tanks, steam-boxes, steam and water hose, etc. Large tobacco warehouses are also equipped with what is known as a re-ordering machine with a drying-room. These are used when tobacco is prepared for the English market, and for tobacco which it is necessary to store for a long period.

All tobacco should be classified before being passed through the re-ordering machine, and for this purpose suitable storing tables are required. Similar tables should be situated near the baling presses, on which the tobacco may be placed before being passed into the presses.

It is frequently necessary to hang the tobacco on laths to dry it. These laths should be about 4 feet in length and triangular in shape, the three sides each measuring about 1¼ inches. Laths of this shape will not turn over when filled with tobacco and hanging in the racks. Tobacco racks or trucks on wheels are needed for carrying the laths when the tobacco is to be conveyed about the warehouse.

When drying-rooms are used the trucks above described may be filled with laths of tobacco rolled into these rooms and allowed to remain until the tobacco is dry. The temperature of the drying-room is usually kept at from 130° to 150° F. though sometimes it is raised to 200° by means of steam passing through several coils of pipes around the sides or near the floor of the rooms, and the hot air in these rooms should be kept in circulation by means

of fans. When the tobacco is dry the trucks are rolled out of the drying-room into a cooling-room, and there remain until the leaves are in proper condition to receive moisture. The tobacco still on the trucks is then moved into an "ordering" room to receive steam until it becomes moist enough to handle. It is then in good condition for storing.

The re-ordering machine subjects the tobacco to treatment on the same principle as the drying-room. Laths filled with bundles of tobacco are hung on hooks of an endless chain or the leaves may be put on a wire-netting belt. The tobacco then passes from one end of the machine to the other and is kept slowly but constantly moving from the time it is put into the machine until it reaches the other end.

From the re-ordering machine, or the "ordering" room, the tobacco is taken immediately to the baling-press.

The choice of baling-presses is usually governed by the requirements. A good, though expensive press, is one which takes a case of suitable size, the necessary pressure being applied by means of a steel screw. A case is filled with tobacco and placed in the press; while the first case is being pressed a second case is filled in readiness for the press when the first bale is removed.

To complete the equipment of a warehouse there may be added sample-boxes, bucksails, thermometers, and thermometer tubes for use in testing the temperature of tobacco stacks, and a few minor articles of more or less importance.

RECEIVING.

Next to the actual buyer and seller, there is no more responsible official connected with the warehouse business than the receiver of tobacco. If the crop has been bought previous to delivery the receiver must decide whether or not it is being delivered according to contract. It is necessary that he should be a close observer and possess good qualification or he will not be competent to detect any irregularity that might occur.

If the warehouse is managed on the co-operative plan, the position of receiver is even more important, for the tobacco is valued by him for the co-operatire society. The old dealers' maxim "tobacco well bought is half sold" proves equally true with a co-operative society as with any other dealer. This means that when the proper valuation is put on tobacco when it is bought, there will be but little trouble in selling it at a reasonable profit. On the other hand, if the valuation is too high it will be difficult to convince the buyer that the tobacco is worth as much as it was valued at.

When farmers deliver their tobacco to a warehouse they expect a settlement. If the crop has been bought by a manufacturer or dealer, full contract price should be paid at once. If delivered to a co-operative society, there should be a system by which the farmer could collect an advance payment on the delivery of his crop. The margin between the amount of this payment and the value of the tobacco should be sufficiently large to insure safety in the business. This necessitates care in keeping the books, which work should be done by competent men.

BULKING.

There should be no pressure other than the weight of the tobacco placed on the bulk, and it should be left in a loose condition. There should be air-spaces between the stacks, and passages left through which to convey tobacco to and from the stacks. It is necessary to have thermometer tubes in the bulks so that a thermometer can be inserted at differerent places. These tubes need not be expensive ; they may be made with three sides and just large enough to hold the thermometer. The sides, which may be of ordinary wood, should be perforated so that the heat from the tobacco will have access to the thermometer and the correct temperature recorded. The proper amount of moisture in tobacco, so that the temperature will rise high enough but not too rapidly, can be judged only by experience.

FERMENTING.

If tobacco is too dry when bulked it will not only break in handling, but will not ferment well. If, on the other hand, it is too wet, it will either become mouldly and have a bad odour, or will turn a dark colour if allowed to remain long in bulk. In either case it will deteriorate in value.

The temperature should rise slowly until it reaches 120° F., when the bulk should be broken down and a new one made. The outer portion of the old bulk should be the centre of the new, and the centre of the old bulk should be used for the outer part of the new. It has been found that if the temperature does not rise above 120° F. the leaf is usually improved in fermenting, but if the temperature reaches 140° the ordinary tobacco of the Transvaal turns a dark colour, which greatly decreases the value.

CLASSIFYING.

If the tobacco has good burning qualities (without which it has but little value) the classifying should be done according to colours, length, breadth, and weight of the leaf. This work can only be done by experienced sorters capable of judging between leaves of different values. It has been said that a good tobacco man is born, not made, meaning that some have a natural aptitude for detecting the difference in quality, while others can never become experts at this work. To classify tobacco properly and rapidly requires good judgment and close attention to the work. Graders should be provided with tables, situated in a good uniform light. In South Africa the south side of the house is the best for the windows, as the sun never shines directly on to the sorting tables from that direction, and the windows should be at the side or behind the graders.

ORDERING AND BALING.

When tobacco contains too much moisture it should be treated to the drying process described in this article. If, on the other hand, the tobacco is too dry it should be moistened by placing it in a steaming-box made for the purpose, and steamed. The steam may be led into the box by means of perforated iron pipe, which should enter the box from one of the sides and close to the bottom, and the box should be as nearly steam-tight as possible. A drawer on rollers is provided to contain the tobacco and for rolling it into the steam-box. The steaming of tobacco should be very carefully done ; if it is allowed to remain exposed to the steam for only a few seconds too long the leaf may be greatly injured. When the tobacco has absorbed sufficient moisture to make it pliable, it should be put immediately into the baling-press.

As the bales are made they should be wrapped with fine hessian, and if intended for export the bales should first be wrapped in oil-paper then with hessian, so that the moisture from the sea will not affect the tobacco.

SAMPLES.

A sample may be drawn from each bale or one sample may represent several similar bales. Numbers on the samples must correspond to the numbers on the bales which the samples represent, and a complete record should be kept of each bale so that it can be traced to its destination. Samples are the basis of transactions between buyer and seller. Each sample should be carefully made so that it will fairly represent the bale or bales from which it is drawn. A card bearing the number and other marks of identification necessary should be affixed to the sample. As a protection to both buyer and seller the card may be affixed with a seal.

SELLING.

There is no more important part of the warehouse business than that of selling the tobacco. An important point is to inspire confidence in the buyer by convincing him that he will receive fair treatment, and that when he gives an order the goods will be delivered according to contract. The salesman can also advise farmers to grow such grades of leaf as the trade demands.

In considering a business, the first question which is usually asked is, "does it pay?"

In South Africa at present there is only one tobacco warehouse conducted on the co-operative plan. Tobacco delivered to this warehouse for the past two years was settled for at full market prices, with no expense to the farmer. By reference to the report of the auditor for the year 1912, we find that the gain in value of the tobacco handled in the co-operative warehouse was sufficient to pay all expenses of the business and still leave a balance of more than £6000 net profit to the co-operative society.

It would be well for all tobacco growers in South Africa to consider whether or not it pays to operate a co-operative warehouse.

RAINFALL FOR JANUARY, 1914.

Place	1914	1913	Place	1914	1913
	in.	in.		in.	in.
Colombo	19	8.34	Kurunegala	·81	17·79
Kandy	2·78	22·58	Batticaloa	16·76	53·77
Galle	1·17	8·09	Ratnapura	1·70	15·64
Jaffna	1·35	4·07	Badulla	8·32	40·43
Anuradhapura	1·42	12·68	Nuwara Eliya	2·17	24·75

COTTON.

THE SILK COTTON TREE.

One of the trees found throughout the Bombay Presidency and a very conspicuous object at this time of the year when it is covered with numerous large, bright red, cup-like flowers at the end of bare branches, is the Bombax Malabaricum known as "*Sawar* or the Silk Cotton tree." It is a large deciduous tree with wide spreading branches and armed with prickles on the bark and is generally found on dry hills. It is very common in the Konkan, and those who have visited Matheran during the Christmas holidays must have noticed it on the slopes along the steam tramway line. The leaves begin to drop soon after the rains are over, and the tree is then entirely bare from January to March when it flowers. The flowers are succeeded after some time by large pods containing numerous seeds employed in an abundance of white silky hair which, on the pod opening when ripe, comes out in the form of a downy heap, and when sufficiently dry is scattered all round the tree, carrying the seeds to long distances. The cotton obtained from the capsules is known as *Simul*, and though not well adapted for spinning is an excellent material for filling beds, cushions and pillows, and is largely used for this purpose here and is also exported to Europe. The oldest tree of this kind in the Victoria Garden, a little to the north of the Garden Office, is now in full blossom with a much younger one close by also in flower.—INDIAN AGRICULTURIST.

COTTON AT A MADRAS AGRICULTURAL STATION.

The work of the improvement of the Tinnevelly cotton crop has now reached a stage when the results of seed selection work are now bearing fruit. Last year three single plant selections had reached a stage when they could be grown on a field scale and of these it was decided that one of them could now be put on to a seed-farm. Accordingly arrangements were made with a ryot of the adjoining village to grow 20 acres of this selection for the Department for seed. This has done exceptionally well; not only is the crop bearing heavily but it is giving a cotton of excellent quality which MR. STEEL of MESSRS. A. & F. HARVEY & Co., who has an expert knowledge of Tinnevelly cotton, values it at least ½*d*. per lb. above F.G.F. Tinnevellis. Not only this; but the strain ginned at 28·25 per cent. against the 25 per cent. average of the district. This selection excels in yield, quality and percentage of lint to seed, and is admitted to be the best crop in the village. Many ryots are anxious to obtain seed of this next year. This opens up a splendid field for village co-operation. The ryot is always careless of his seed, but in the neighbourhood of the Agricultural Station (Koilpatti) the adjoining villages are now learning

the value of good seed and it may be estimated that this strain will bring in an increased value of crop worth, at present prices, at least, Rs. 16-4-0 per acre estimated as follows :—

	Rs.	A.	P.
Increase in yield, ¼ pothie (61 lb.) ...	7	8	0
Increased value of kappas due to higher ginning percentage	5	0	0
Increased value of cotton due to better quality	3	12	0
Total ...	16	4	0

Of this Rs. 16-4-0, without co-operation, the ryot would not get more than about Rs. 12 ; while there is no reason why with co-operation, he should not make at least Rs. 20, since the seed obtained from such a crop would have a much higher value for seed purposes when once the existence of such an improved strain became known in adjoining villages.

Thus, in this one village which grows 750 acres of cotton a year, on this basis, the value of the introduction of such an improved strain would be Rs. 15,000 per annum.—REP. OF THE DEP. OF AGRIC., MADRAS PRESIDENCY.

COTTON BLIGHT IN EGYPT.

It is feared that the high expectations regarding the cotton crop will not be realised as it is already reported that the whole of the third packing and part of the second have been lost, owing to the disastrous ravages of the boll worm. This pest is having an increasingly serious effect on the crops every year. The Government has issued a circular recommending cultivators to pick off and burn all the bolls left on the cotton sticks before stacking them for the winter, but this precaution will involve a good deal of extra labour, and as the fellaheen usually declines to do anything out of the ordinary unless compelled by law, it is doubtful whether a systematic stand will be made.—UNITED EMPIRE.

LEMON GRASS IN FIJI.

C. H. KNOWLES.

The writer gives the results obtained at the Nasinu Experiment Station with a lemon-grass (*Cymbopogon Coloratus Stapf*), introduced in 1907 from India. The most favourable time for harvest is when the plant has reached 3 or 4 feet in height before the flowering period is advanced. The percentage of oil in the young plants is greater than that of the old ones, but the total yield obtained is less. Thus a plot cut four times produced only one-third of the quantity of oil obtained during the same time from a similar plot cut only once after reaching 4 feet in height. The estimated yield of oil is 43 lb. per acre per cutting.

Distillation experiments show that the process should not continue longer than four, because the amount of essence produced after this time is unprofitable. The profits per acre should reach £2 per cutting, and two or three harvests are obtainable in the year.—MONTHLY BULLETIN.

SOILS AND MANURES.

MANURES AND SOIL FERTILITY.

F. B. GUTHRIE.

(*Continued from p. 114.*)

These experiments have so far been carried out in the laboratory. If means are discovered of partially sterilising the soil in the field, a most valuable method of increasing the fertility of the soil will be placed at the disposal of the farmer.

Indeed, experiments in this direction have been recently carried out by E. J. RUSSELL AND J. GOLDING§ on "sewage-sick" soils. They find that "sewage-sickness" is an abnormal development of the factor harmful to bacteria (protozoa) always present in ordinary soils, and that the loss of efficiency in the purification of sewage in such soils is due to the hindrance of the development of the bacteria. Small land-filters were made in the field, some being filled with untreated soil and others with treated or sterilised soil. The effluents were examined periodically. The untreated samples soon became "sewage-sick," whereas the effluents from the treated filters retained their efficiency for months. A further experiment was tried by treating small plots in a similar manner, the plots being then sown with turnips. The crops on the treated plots (especially that treated with toluene) were not only better than those from the untreated, but suffered much less from "finger and toe."

Further interesting trials were recorded by E. J. RUSSELL and F. R. PETHERBRIDGE‖ of the action of heat and antiseptics upon sickness in glass-house soils. In countries where plants like cucumbers and tomatoes are grown under glass, the soil is found to be unsuitable for the growth of these plants after a short time sometimes after the first crop. The soil used is therefore thrown away, and as it is necessary to enrich it very much with manure and to expend much time and labour on its preparation, this is a very wasteful operation. The authors find that previous steaming of the sick-soil of a commercial glass-house in which cucumbers were grown, resulted in curing the soil of cucumber sickness and rendering it once more commercially profitable. The same was found to be the case with tomato-sick soil on which a number of different antiseptics were tried. Of all methods, heating the soil to 98° was to be the most effective. The cost of this operation is from 1*s.* to 1*s.* 6*d.* per ton of soil, which while profitable in the case of plants grown under glass, is quite prohibitive on large areas.

S. U. PICKERING** considers that on heating a soil the amount of soluble plant-food is increased and the changed bacterial conditions studied by RUSSELL and HUTCHINSON conduce to more vigorous growth, but that at the same time certain toxic substances are formed which arrest plant growth, but as these toxins are unstable and readily oxidised the toxic conditions do not prevail for any length of time.

§ *Journ. Agric. Science*, Vol. 5, p. 27.

‖ *Ibid*, p. 86.

** *Journ. Agric. Science*, Vol. 3, p. 27.

F. FLETCHER* obtained very much higher yields with maize plants grown in soil previously heated, which results he attributes to the destruction by heat of an alkaloid dihydroxystearate. He also finds germination injuriously affected by previous heating. This he attributes to increased osmotic activity which results in a decrease of imbibition, brought about by increase of soluble organic substances.

R. GREIG-SMITH,† to some extent opposes the conclusions of RUSSELL and HUTCHINSON. The beneficial action of disinfectants, such as chloroform, toluene, etc., is explained by him as being due to the removal, by these reagents (all of which are wax-solvents), of a wax-like substance (agricere) with which the soil particles are coated. With the removal of this water-proofing the soil nutrients are more easily dissolved in the soil water and attacked by bacteria.

According to this investigator, the principal nitrogen-fixing bacterium in soils is *Rhizobium leguminosarum*, the number of which affords an indication of the comparative fertility of the soil, and which, in the most fertile soils, may be present to the number of three or four millions per gramme of soil. He finds, further, that all soils contain a substance which acts as a bacterio-toxin, fertile soils containing a small, poor ones a large, amount. This toxin is destroyed by heat, sunlight, and storage, and is washed into the sub-soil by rain, so that after a shower of rain the surface soil is richer in bacteria than the lower strata. This latter is an extremely interesting observation, as indicating that the beneficial effects of rain or of irrigation are not confined to the mere supply of water or even of fertilising salts to the soil.

These bacterio-toxins are insoluble in wax-solvents, and are not volatile.

He finds also that after the protozoa have been destroyed by heat at 65° to 70°, the action of volatile disinfectants is to increase still further the bacterial productiveness of the soil.

If the theory that the action of heat and of solvents is to destroy the waterproof coating is correct, one would expect that the soils so treated would yield more of their mineral ingredients to soil-solvents. The evidence on this point is not conclusive, but it is fairly certain that the increases, when such have been found, are insufficient to account for the great increase in fertility noted by RUSSELL and HUTCHINSON (three or four times the crop in the case of heat, and 20 to 50 per cent. in the case of volatile antiseptics).

There are thus several theories in the field to account for the action of heat and of antiseptics upon the soil. On the one hand, it is attributed in both cases to a partial sterilisation of the soil, as a result of which certain organisms are destroyed which are hostile to the ammonia-producing bacteria; on the other hand, the action of antiseptics may, it is suggested, be due to the removal of an impervious wax-like material surrounding the soil grains, the presence of which hinders their being attacked by soil-solvents; and in the case of heating a third suggestion is that at first both harmful and beneficial organic substances are produced, the harmful ones being readily oxidised.

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* *Cairo Scient. Journal*, 1910, 4, reprint (abstract in Chem. Soc. Journ. Abstracts Vol. 100, ii., 350.)

† *Proc. Linn. Sec.*, N.S.W., Vol. 35, p. 808; Vol. 36, pp. 492, 609, 679.

EFFECTS OF FERTILISERS ON PHYSICAL PROPERTIES OF SOIL.

Soluble salts in small quantities exert an influence upon the physical properties of soils. AIKMAN* points out that the quantities of fertilising matter in farmyard manure are insufficient and in an unsuitable form for the growth of crops, and that the chief influence of such manure is on the structure of the soil. R. O. E. DAVIS has studied this influence more particularly in the case of the apparent specific volume of the soil, rate of capillary action, and change in vapour pressure.

He finds that most fertilisers accelerate capillary movement, sulphate of potash and a mixture of sulphate of postash and phosphoric acid retard it. Soluble salts, whether acting as plant-food or not, may produce in the soil changes in structure which in turn influence plant growth. Their effect is most pronounced in soils containing a large amount of fine particles.

INFLUENCE OF FERTILISERS ON SOIL MOISTURE.

The action of soluble salts in affecting the moisture conditions of the soil is of great importance. CAMERON and GALLAGHER† have shown that the physical nature of the soil changes with its moisture-content, and consider that for every soil that is an optimum moisture-content at which its physical condition is more favourable for plant growth.

Of the various problems presented by a study of the physical nature of the soil, the one which is of the greatest importance is the question of the behaviour of water in the soil. This applies with special force to us in Australia, where the problem of conserving the soil-moisture is of even greater importance than that of manuring. The action of fertilisers, especially potash salts, in keeping the surface soil moist, is well known. The application of fertilisers has been found to have a very considerable effect upon the transpiration ratio of plants, enabling them to make a better use of the available moisture.

In fact J. W. LEATHER‡ in the course of an investigation into the water requirements of crops in India, finds that the transpiration ratio (that is the relation between the weight of water transpired by the crop and the weight of the dry crop) is always lower when suitable manures are employed, and concludes that "speaking generally the effect of suitable manure in enabling the plant to economise water is the most important factor which has been noticed in relation to transpiration."

It appears possible, however, from more recent researches of the same author§ that the decrease in the transpiration ratio when suitable manures are added, is due rather to the more vigorous growth of the plant than to any specific action of the manure on the transpiration ratio.

DR. LEATHER has, at all events, shown this to be the case with superphosphate, which when supplied to a soil known to have no need for phosphatic manuring did not lower the transpiration ratio.

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* Manures and Manuring, p. 273.

†Bull. 50, Bureau of Soils, U.S.A.

‡ "*Memoirs*," *Dept. Agri. India*, Chemical Series, vol. 1, No. 8, p. 170.

§ "*Memoirs*," *Dept. Agric. India*, Cheml. Series, vol. 1, No. 10, p. 230.

This, however, is a case in which it is possible to confuse cause and effect. The soil in question was unusually rich in available phosphoric acid, containing more than three times as much as the richest of the other soils, and it is not impossible that the transpiration ratio was affected by the presence of soluble phosphoric acid in the soil.

J. W. PATERSON‖ has published results of experiments to determine the transpiration ratio of oats, which are of interest in this connection, although the question of the effect of manuring does not enter into the investigation.

He finds that the transpiration figure for this crop, grown in pots and partially shaded during the period of their growth, to be about 483, that is to say, 483 tons of water are transpired for every ton of dry crop produced.

He assumes that for plants of moderate development, grown in the open air in Victoria, this figure would be 700, as against 870 in India (LEATHER, *loc. cit.*); 522 in America (KING); and 665 (WOLLNY) to 376 HELLERIEGEL) in Europe.

According to LEATHER a 13-bushel crop of wheat (about 1 ton grain and straw) will transpire 693 tons of water (or 6·8 inches of rain) per acre in India. DR. PATERSON states that local conditions indicate that about 600 tons of water (6 inches of rain) per acre would pass through a 13-bushel crop of wheat during its growth under Victorian conditions.

The above short review of the work which is being done in the solution of a certain class of soil problems shows that the action of fertilisers is not confined to supplying the crop with food, but that it is far more complex, and that fertilisers influence the physical structure of the soil, aud also its biological and chemical condition in a great variety of ways; further, that we have to take into account a large number of factors which affect the fertility of the soil and which are quite independent of its supply of plant-food.

We have seen that fertilisers may exert an influence on the toxic matters produced in the soil, the texture and the moisture-condition of the soil, on the development of bacteria or fungi, on the oxidising power of the soil, and that quite remarkable effects are produced by substances added in quantities much too minute to act as nourishment to the plant.

I do not for a minute desire to underrate the great importance of manuring in maintaining the fertility of the soil. I only wish to emphasise the point that the old conception of manures as acting solely by supplying plant-food must be abandoned.

There are, I venture to think, very few who would now-a-days recommend a particular manure formula based, on the one hand, on the composition of crop, and on the other, on the composition of the soil.

It appears to me that for the next important advance in our knowledge of fertility conditions we must look in the near future to the plant physiologists and the bacteriologists.

The great rôle played by toxic substances, perhaps of bacterial, perhaps of chemical origin, leads us to look for substances which shall restrain their development—for antitoxins.

‖ *Journ. Dept. Agric.*, Victoria, vol. 10, p. 349.

Just as diseases in men and animals are being combated by the discovery of substances which retard their progress, so it may be hoped that our plant physiologists may be able to discover antitoxins which shall render harmless the poisons which are secreted either by the growing plant or by the metabolism of organic matter in the soil, whether such substances are produced by bacterial agencies or by purely chemical changes. We shall, no doubt, find that many substances which we now apply in the confident anticipation of increased crop production act less by virtue of any special plant-food with which they supply the crop than through their power of retarding or preventing the formation of substances hostile to plant growth.

Soil-analysis will in the future concern itself less with the elaboration of methods for determining the proportions of plant-foods than in searching for conditions likely to produce toxic substances, and for means to overcome them. Unfertile conditions, whether due to soil bacteria, fungi, or the formation of poisonous chemical substances, will be combated by the same weapons as are now employed against similar diseases in men and animals.

Whilst there is no intention in all that has gone before to suggest for a moment that we should cease to manure with the recognised fertilisers—potash, nitrogen, and phosphates—or that we should cease to conduct experiments as the best proportions of these manures for different crops, still I feel that future progress in this matter lies more with actual farmers' experiments, where the principles already established by careful scientific investigations can be tested and modified to suit local conditions. I feel that the time occupied in elaborate manure experiments on the old lines, and in the elaboration of methods of soil analysis on the old lines, would be better spent in the study of other factors productive of soil fertility or infertility—such as some that I have outlined above and I hope that it may be possible for some of our Australian workers to devote more time to plant physiology, to the study of soil toxins, and the elucidation of the conditions which render a soil fertile or infertile—whether these are physical, chemical or biological in their nature. —SCIENCE BULLETIN, NEW SOUTH WALES.

THE OIL PALM.

The oil palm (*Elæis Guineensis*) is the source of palmetto-oil and palm oil. The former is used in the preparation of vegetable butter, for which there is an ever-increasing demand. The latter is in request by soap-manufacturers, being the most suitable fat for their purpose. The price of palm-kernels, which 20 years ago was 8*s* to 10*s* per cwt., has now reached 24*s* to 26*s*.

The introduction of this African palm into Asia has given very encouraging results. Its growth is satisfactory and the yield and richness of the fruit are superior to those in Africa. Experiments show that one acre of these palm trees yield more than 2,500 lb. of palm-oil, producing a profit of £24 per acre. The cost of establishing and maintaining till bearing begins reaches £32 per acre. These trees come into bearing in four years.

In the province of Tamiang in Sumatra, preparation has been made for planting 7,500 acres per year.—MONTHLY BULLETIN.

DRY FARMING.

To the Editor of the Tropical Agriculturist.

Sir,

I have been astonished at the apparent distance the journal you so admirably edit penetrates. I have received letters from various parts of India and Burma and a large number from Ceylon in respect to my letter in reply to Mr. Freeman, asking me a variety of questions.

I should be obliged if you would make my excuses through your columns. It is impossible for me to reply to each individual and enter into such correspondence. I feel sure on reflection my correspondents will appreciate my inability.

I would however like to express the opinion that a special meeting of the members of the Ceylon Agricultural Society be convened to enlighten them fully upon the practice of "dry cultivation" as indulged in other countries and the results obtained.

I notice, Sir, that the "King's Speech" contains reference to the unfortunate failure of crops in India owing to lack of rains. I submit, Sir, that such a position need not arise and that at least two years' crop can be safely provided for with proper cultivation of the soils and that a twelve months' drought would therefore not entail the distress now occasioned.

The Central and North-Central Provinces of Ceylon are blessed with a splendid soil, a periodic rainfall and I venture to submit that a duty is imposed upon us to reclaim those lands to man's benefit and utilize them to teach the East the art of dry cultivation. I further venture to submit that such undertaking will harmonize with the establishment of a College of Tropical Agriculture which we all hope will be established in Ceylon.

Yours obediently,
D. M. WEIGEL.

Jesmond Dene,
Colpetty, 12th February, 1914.

IN INDIA.

LETTER FROM A CEYLON STUDENT AT POONA.

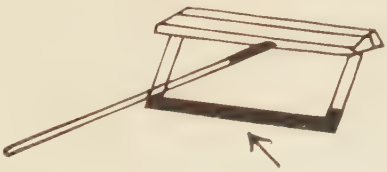
I had been very interested in the discussion that has arisen about "Dry Farming." This has been taken up and worked somewhat successfully here in the Bombay Deccan where the rainfall is scarcely above 20 in. annually.

One fact of very great importance must here be emphasised with regard to conditions as compared with other arid regions (e.g., United States of America). The soil here varies from 2 in. to 2 ft. and the sub-soil is often decomposed "trap" which is so pervious as to cause a serious loss by underground drainage. This has appealed to Mr. Keatinge, the Director of Agriculture, very forcibly when he paid a visit to America and he is of opinion

that the principles as applied in America will not hold here. Some other serious factors about our soil is its marked deficiency in organic matter as well as its tendency to crack forming very wide rifts during the dry season. These often suit field-rats admirably and they cause serious loss to any standing crop. When the soil is ploughed clods are formed very much larger than a man's head and the practice here is to allow the sun to disintegrate them when a heavy log of wood dragged over it is sufficient to crumble and pulverise them. PROF. KNIGHT had worked for some time trying to devise a better cultural method as it is evident that there must be a tremendous loss of soil moisture. Here one meets with an interesting problem as suggested by the village cultivator. He does not see the necessity there is in pulverising these clods as he believes the sun aids him in making the plant-food available and especially when his soil is shallow there appears to be a very great deal of common-sense in this theory because the decomposed trap-rock that forms the sub-soil needs aeration to be converted into soil proper. Thus in attempting to conserve moisture one runs the risk of not having his plant-food in available form. It is one of the best examples I can think of as to how local conditions must modify one's methods and principles. Another instance was in the introduction of iron ploughs, here one had carefully to advise cultivators as to regulating the depth of their ploughing as inverting the soil and thus bringing up the sub-soil gave often very poor results. Some experiments had been carried on the College Farm as preliminaries to Dry Farming. They were known as Superior Tillage vs. Ordinary Tillage. In the first case there were two ploughings, immediate pulverisation with a harrow and weekly intertillage as long as the crop would admit of it. The ordinary tillage represented the practice of the village cultivator of one ploughing, subsequent harrowings and interculturing as ordinarily given by the cultivator.

The experiments gave interesting results, in the former case giving a good balance profit thus suggesting the possibilities in a better treatment of the soil. The disc harrow has proved to be the implement *par excellence* for forming a loose mulch and preventing the soil from cracking.

The indigenous implement used is known as a "blade harrow." It can best be understood by the diagram where an iron blade is attached to a head-piece by two coulters driven at an angle that varies according to the depth of soil to be worked. Its greatest disadvantage is the great draught needed whilst as a clod-crusher it is hardly effective. As a weed-killer it can find no equal, and for sub-soil packing it would be useful after the disc-harrow has pulverised clods and made the land workable. Thus after sowing seed it may with advantage be worked.



IRON BLADE

In seed-drills there is much to be desired in having a mechanical contrivance for dropping seed at regular intervals. The "Clipper" seed drill (MONTGOMERY WARD & Co.) has come nearest to the ideal implement needed here and with regard to spacing the number of plants, it has been

found that thinner seeding is more profitable, thus using half the quantity of seed and sowing in rows of 18 in. (i.e., double the present distance for the bullrush millet) better crops resulted due doubtless to the splendid facilities for intertillage. Here the Planet Jr. cultivators have proved the best and one of the features of the Agricultural Demonstration held last September here was the marvellous results obtained by just this practice of frequent intertillage. The fodder varieties of sorghum responded very well and grew to an average height of 8-10 feet. The rainfall up to that time had not been more than 15 inches.

In the year 1911-12 some interesting results were made out on our College Farm. The rainfall was only 13·72 inches and still our average outturn of Broach cotton was 600 lb. whilst one student had as much as 960 lb. per acre. The average outturn in the Presidency is never more than 500 lb. at the best. The tremendous possibilities that lie in the intertillage is thus clearly proven.

Then land that was left fallow for one year and only cropped the alternate year gave as much as 770 lb. of grain whilst the cropping of land for two successive years could only average 733 lb. The fallow was kept clear of weeds and carefully protected by a mulch. In the next observation I quote PROF. KNIGHT's own words (Bomb. Presd. Rep. 1911-1912):—

"An interesting observation has been made on the College Farm bearing on the subject of holding over soil moisture in the soil from one year to another. Uniform treatment and cropping was given to an area one-half of which had been irrigated the previous year while the other half was cultivated dry, but growing the same sort of crops; those on the part that had been irrigated the previous year were able to resist the trying breaks in the unfavourable monsoon, whereas those on the adjoining area which had not been irrigated the year before succumbed to the drought or were badly injured and in the end the yield was only one-half of that of the plots of the irrigated portion."

HENRY L. VAN BUUREN.

THE PALMYRA PALM IN WEST AFRICA.

The wood of the Palmyra palm (*Borassus flabelliformis*) is very valuable for building on account of its large dimensions and rigidity. Its popularity leads to unfortunate results, for its utilization for European buildings takes precedence over the numerous uses of the leaves and fruits, so that there is danger of its extinction in the parts of the Sudan bordering on the Sahelian zone (upper Senegal and Niger).

The natives make use of the pericarp only; the kernels, which constitute one-third of the weight, may be used as a substitute for coroso, and a price of £16 per ton has been offered for them at Hamburg.

Certain precautions must be observed before a marketable production can be obtained. The nuts should be gathered soon after their fall to prevent germination, and the kernels must be thoroughly dried before opening, to prevent mould. At present two concessions have already been sought in West Africa.—MONTHLY BULLETIN.

POULTRY.

SOUTH AFRICAN EGG LAYING COMPETITION.

S. A. WEST.

The egg record for the month shows 3,103 eggs laid, but 88 have to be deducted for being under $1\frac{3}{4}$ ozs. The total for the month is a considerable improvement on that of July, and may be considered fair. It is practically the first month of the competition, as the effects of the general moulting have passed, and a steady increase of eggs has resulted. On the 1st of the month there were 66 eggs laid, rising to 134 on the 31st, more than double the number; and on the 17th to the end of the month over 100 each day, the highest record being 146 on the 27th. Two pens, Nos. 7 and 10, laid over 100 eggs each, but deductions for underweight in these, as well as in pen 4, reduced their totals from 21 downwards. Nineteen pens had no deductions on this account. All but three pens had under six below weight, and most of them one or two only. The total number of light eggs for July was 120, so that there is a considerable improvement this month, and probably during September, correspondingly fewer of these unsatisfactory deductions will be recorded. The record for the month averages $77\frac{1}{2}$ eggs per pen, or practically 13 per bird; this is not as good as it should be, and a careful study of the conditions lead me to think that a better record might be made. I would like to note a few points of this competition before going into the above.

VALUABLE DEDUCTIONS.

It cannot be expected that birds in a strange place, under different conditions of treatment and feeding, would do as well as they would at home where a free hand is allowed. There are also climatic changes to be taken into account as well as the food; as far as quantity of the latter goes, the heavier breeds especially have more than the regulation amount of both grain and soft food if necessary. This does not seem to be understood, or that the pens are studied individually and treated accordingly, though the total amount given approximates to what is laid down as necessary. No stimulants whatever are allowed in this competition, either in the form of green bone, or any simple well-known and generally used form. It is a rule that the feeding must be as simple as possible. The supply of green food is very irregular, and a decided factor against a heavy egg production. The efforts made to get this very necessary food supply have been disappointing to all concerned. Warmer weather will of course, cause a growth of lucerne, and with the supply later obtainable from the plants here, will remove the difficulty. The sprouted oats have saved the position, but care has to be used not to feed these too heavily, as the birds are exceedingly fond of them and will eat them almost before anything else, to repletion. After four months' trial I think that the granulated whale meat causes a looseness of the bowels,

which must be detrimental. It is possible it is in too concentrated a form, or not sufficiently sterilised, but it is necessary to avoid anything in the feeding which acts as an irritant to the birds, however good the analysis may be. The foregoing conditions probably account for the egg supply not being larger.

CHARCOAL ESSENTIAL.

The importance of Charcoal in keeping the birds in health has been especially noticed this month, as there has been a heavy feeding of it, and the hoppers have been recharged every few days. Birds in confinement especially should never be without it. The weather has been more uniform during the month, generally dull with some heavy rains, but fairly even temperature, and not very cold. There was a rough time during the heavy downpour and flood, but as the ground generally dries soon, the birds did not show any ill effects. Their health generally has been good with no serious ailments to report. There have been six cases of broodiness from pens 2, 4, 5 and 21, of about a week's duration, but another bird from pen 4 has been persistently so, off and on, during the month.

A great uniformity in laying will be noticed this month. No pens stand out clear from the others, even without deductions. With the spring and warmer weather, a marked increase should result next month, and a good record be set up.—South African Poultry Magazine.

CHICKENS AND BEES.

W. R. BARTLETT.

The combination of bees, poultry and, I might add, an orchard, is an ideal one. We have two acres of land in a young orchard, and here we have the bees and poultry. A good growth of elderberry bushes and small trees on the south, east, and west lines of the lot, and the poultry-buildings on the north, furnish a good windbreak. We have from 1,000 to 1,500 chickens and 50 colonies of bees.

As we hatch all our chickens with incubators we are enabled to produce eggs and broilers (cockerels) when the prices are the highest. We feed the newly hatched chicks nothing for the first 48 hours, after which one of the commercial chick-foods is given every two hours for the first four or five days, gradually reducing the feeding to morning, noon, and night.

The brooder house, one room 28 x 16, is divided into pens by poultry wire, and a lamp-heated movable hover is placed in each pen of 100 chicks. This admits plenty of pure air, gives scratching-space, and insures perfectly sanitary conditions.

Grit, oyster-shells, and charcoal are continually before all fowls. The morning and evening meals for the fowls of all ages consist of mixed grains thrown into the litter. A dry mash, fed in troughs, is given at noon. Green food is fed to all at nine in the forenoon.

At the age of six weeks the chicks are placed in the colony houses and given the free range of the orchard. About Oct. 1 the pullets are moved to the large winter houses. The males are put with the two-year-old layers during

the breeding season only—from January 1 to June 1. The pullets are kept for laying entirely, as we make a specialty of sterile eggs for table use. We have a special trade in Cleveland, where there is a growing demand for *sterile* eggs.

We have not been in the bee business as long as we have in the poultry business ; but we find business methods apply to the bees as well as to the poultry. A complete system of accounting is maintained. The hives are placed in rows, each one in the shade of a tree. Each hive bears a tin tag on which is painted the row letter, and hive number, enabling one to locate any hive immediately.

In the management of bees and poultry, every man, as he gathers experience, adopts methods peculiar to his own needs and conditions. We have found that it is the best policy to have all hives and parts uniform and interchangeable ; and we therefore purchase all our supplies from one reliable manufacturer, which saves much time and labor.

We operate principally for comb honey. In order to check swarming somewhat we believe in plenty of hive room and ventilation. In the spring all queens are clipped.

We find the smoking plan of introducing queens one of the best.

There are several devices which have proven to be very convenient, among which is a frame the size of a hive covered with wire cloth, which, when placed over the top of the frames, prevents the bees from flying out and robber bees from getting in when the cover of the hive is off. At the same time, one is able to see wh t is going on in the hive. When a hive is being robbed we find a wire-cloth box, large enough to telescope over the entire hive, very effectual.

Early in the fall all colonies that are short of stores are fed a sufficient amount of syrup, so that none have less than 25 lb. for winter. Weak colonies are united by placing one hive on top of the other, with a screen between them for three or four days.

Our bees winter on their summer stands, and are protected with chaff cushions in a super on top (grain-bags, one on each side), together with an outer covering of roofing paper securely tied with a heavy cord.

There are many reasons why the bee and poultry businesses work together advantageously. Each business has its own busy season. The incubating and brooding of chickens is practically over before the busy season with the bees begins. Another advantage of the combination is that the same land can be utilized for both. Besides this, poultry fertilizes the land, bees fertilize the fruit, and the fruit-blossoms furnish the bees with nectar.

Our idea is to have a good laying strain of White Leghorns, a good laying strain of Italians, and to "keep on the job."—Gleanings in Bee Culture.

North Ridgeville, Ohio.

MAIZE AND FOWLS.

Too much maize is not good for fowls, as it brings on liver disease sooner than anything we know. It makes too much internal fat, and also makes blood too fast. Fowls that are fed liberally on it get lined with yellow fat, especially in the abdomen. We have taken it out when it has been ½in. thick—the egg organs become so weak that the hens lay shell-less eggs Even this is not the worst part of it, as fowls which have liver disease are susceptible of many other complaints, especially roup.

It is not always the liver that actually kills them—it is very often that other diseases follow through their being in a weak state. When roup has been incurable, we have found on examination that the liver was diseased, being full of tuberculous matter—it is commonly called scrofula—having white spots on it. Sometimes these spots are only as large as the head of a pin. We have found also in a few instances tumours, which maize is very liable to bring on. In cases where only the ordinary scrofula is coming on, tuberculosis substance forms in small yellow spots about as large as a pin's head ; these sometimes develop so quickly that they are ¼in. through, and the liver more than three times the ordinary size. We have weighed it when it has been from 9 to 11 oz., while the ordinary weight should be from 2½ to 3¼ oz.

Inbreeding also brings on liver disease, from which there are more fowls that die than from all other diseases put together. We have known farmers use maize for years together, and it has effected the progeny so that they could scarcely rear a chicken. They die off when from four to seven days, and from three to six weeks old. It is used so largely simply because it is such a cheap food, and fowls seem to prefer it to any other grain. A little for a change does not hurt, especially in the cold weather.

We use more wheat than any other grain, as that is not so fattening as most other grains are. Next to wheat, we use good oats, which are a splendid grain for a change, but they ought not to weigh less than 40 lb. to the bushel. Hemp-seed is also an excellent grain for the breeding season, especially for the male birds. If this is given there will not be many unfertile eggs. It is also very good in the autumn through the moulting season, as it is stimulating. It is used largely for bringing young chickens into good condition for the show pen, but it is well to change the grain, as the birds like variation.

From October to March it is well to give corn softened by boiling from fifteen to twenty minutes, and standing the pot on one side till it soaks up the water used for boiling, giving it to the fowls when hot. Care should be taken not to boil the grain too much, or use too much water, as it causes it to burst and become sticky, in which state it is not at all liked by the fowls.

They ought not to have as much boiled corn as they can eat but should have a little hard corn to finish up with. When meat is given to the fowls, it should be cut into small pieces just so that the fowls can swallow it easily. If given in too large pieces, one hen gets hold of a piece and runs away with it, and while she is trying to peck it to pieces, the others eat all theirs, and then have a good run to the large piece in which case the hen which ran away with it usually gets none, and, worse than this, should she swallow the large piece she often gets into trouble, as it is apt to cause stoppage in the passage between the crop and gizzard. Where a large number of birds are kept it is well to pass the meat through a sausage machine.—Fiji Planters' Journal.

CEYLON NOTES.

Minutes of a Committee Meeting of the Ceylon Poultry Club held at the Adam's Peak Hotel on Monday, 19th January at 11 a.m.

Present.—MR. K. H. PLUMRIDGE, (President), MESSRS. F. J. REISS, PRESTON PLUMRIDGE, W. H. BRYMER, ALFRED LEWIS, and C. W. JONES, (Hony. Sec. and Treasurer.)

Letters were received from several members regretting their inability to attend.

Notice calling the meeting was read.

(1) Proposed by MR. K. H. PLUMRIDGE, seconded by MR. A. LEWIS that MR. W. H. BRYMER be elected a member of Committee.

(2) DATE AND PLACE OF SHOW.—After lengthy discussion it was proposed by MR. A. LEWIS, seconded by MR. C. W. JONES that the next show be held in Nuwara Eliya early in April, and be run with the Exhibition being held at that time by Nuwara Eliya Agri-Horticultural Show Committee, provided the terms asked for be agreed to.

(3) Proposed by MR. F. J. REISS seconded by MR. C. W. JONES that, in view of the difficulty in obtaining judges at our shows, MR. BULLMORE of Madras be asked to judge the forthcoming Nuwara Eliya Show and, failing MR. BULLMORE, MR. ABBOTT be invited.

(4) It was proposed by the PRESIDENT that H. E. THE GOVERNOR of CEYLON be asked to become Patron of the Club.

That the HON. MR. R. E. STUBBS be asked to become Vice-Patron.

That the following gentlemen be Hony. Members of Committee :—

The HON. THE GOVT. AGENT, Western Province, the HON. THE GOVT. AGENT, Southern Province, the DIRECTOR OF AGRICULTURE, MR. C. DRIEBERG, SECRETARY Board of Agriculture.

(5) THE PRESIDENT then proposed that in view of the heavy expenditure necessary to run the Club successfully that at the next general meeting to be held in October 1914 the subscription be raised to 15/ per annum.

This matter will of course have to be decided by the members at that meeting, but the proposal will be brought forward by the President

(6) The following was then unanimously carried :

That DR. J. LL. THOMAS now resident in England be elected an Hon. Member of the Ceylon Poultry Club for life, and that he be asked to act as the Ceylon Poultry Club's representative in England. This is in view of the fact that he was one of the founders of the Club and one of its foremost officials during his time in Ceylon.

(7) The Nuwara Eliya Show Committee was then elected :—

MR. K. H. PLUMRIDGE, MR. W. H. BRYMER, MR. PRESTON PLUMRIDGE, MR. HEW KENNEDY, MR. EDWIN DE LIVERA, MR. C. DRIEBERG, and the HON. SECRETARY.

(8) The matter of the strong box made to hold the Club Cups and property was then brought forward, and it was decided to ask MR. LEWIS, if possible, to sell same in Colombo.

(9) Importation Scheme.—Proposed by Mr. C. W. Jones, seconded by Mr. F. J. Reiss that an importation scheme be got out. The matter was left in the hands of the Secretary, to circulate members, and see what support could be got.

(10) The following new members were then proposed by the Secretary and duly elected:—

Mrs. Ingram, Pelmadulla Group, Pelmadulla, Mrs. Marcel, Choisy, Pundaloya, Mrs. Boucher, Duckwari, Rangalla.

A vote of thanks to the chair terminated the Meeting.

C. W. JONES,
Hon. Secretary & Treasurer,
C. P. Club.

Castlereagh, Dikoya.

A FEW REMINISCENCES BY AN OLD MEMBER.

In our last Magazine "Ruminations on the Show" reminds me of my early recollections of poultry. On my return from the Continent, in the sixties, I was greatly taken with a Light Brahma cock mated to a Dark hen.

In 1890 I started poultry out here, having had a setting of Imported Barndoor eggs given me, and for a long time I kept this breed. Unfortunately one night I had every bird stolen, bar a clutch I had in an outhouse. In 1896 (I remember the date well, as I was down in Colombo to meet a brother-in-law, who had just arrived in the Island) a well-known Lindula resident imported a pen of Golden Wyandottes. Can this be the same pen that an "Old Exihibitor" mentions in his notes?

Think of this: in 1902 I had some Black Orpingtons, and just before the Show I sold a cock and two hens for Rs. 30. These birds swept the board. As it has been remarked before, what becomes of the numerous fowls imported into Ceylon? Go round to any bungalow and you will find that not 25% keep pure bred fowls.

Villagers and our coolies seem to have benefited more.

"SNOW-WHITE."

CURE FOR CHICKEN POX.

To The Hon. Edit. Secretary., Ceylon Poultry Club Magazine.

Dear Sir.—I was told of two cures for Chicken Pox in Fowls (1) Roup Powder and Saffron mixed in equal parts, and applied as a paste to the scabs. I recommended this to a friend, who treated his birds and who found that this paste dried up the sores in a very short time. (2) Tincture of Iodine. A neighbour had a clutch of 10 Buff Orpington chicks, 5 weeks old, that were suffering from chicken pox. I recommended Tincture of Iodine. The chicks could just see to eat, and after treatment not one died. I may mention he had lost two hens from this disease that were sitting on eggs.

I had some young Black Orpingtons a few months old and a Bantam hen, the latter a very bad case of Chicken-pox. I used Iodine and consider it the very best cure that I have ever come across

Yours, etc.,
K. H. PLUMRIDGE.

BLUE ORPINGTONS.

As there are now quite a few members of the Club who keep BLUE Orpingtons, the following notes taken from The Blue Orpington Club Book of Great Britain, will be of general interest.

General characteristics of Cock :—

HEAD. Small neat and carried erect. Beak, strong and nicely curved. Eye, bold, bright and intelligent. Comb, single, fairly small, erect, evenly serrated and free from side sprigs. Earlobes, small. Neck, nicely curved, compact with full hackle.

BODY. Breast, broad, deep and full (not flat) with long straight breastbone; Back, short and broad; Saddle, rising slightly with full flowing hackle; Wings, nicely formed and carried close; Skin and Flesh, white, fine in texture and firm; Tail, short and compact and inclined backwards.

LEGS AND FEET. Thighs and shanks short, strong and well set apart. Toes, four in number and well spread.

GENERAL SHAPE AND CARRIAGE. Cobby and compact, erect and graceful. Size and weight, large, from 10 lb. to 14 lb. when fully matured.

GENERAL CHARACTERISTICS OF HEN.

HEAD, NECK, BODY, LEGS, FEET, SKIN & FLESH, corrresponding with cock. TAIL, neat, small and inclined backwards with a gentle rise.

SIZE AND WEIGHT. Large from 7½ lb. to 10½ lb.

COLOUR.

Beak, blue; Eye, black or very dark brown, black preferred. Comb, Wattles; Face and lobes, Bright red; Legs, Black or Blue. Toe Nails, White. Plumage of Cock,—Neck, Saddle, Hackles, Wingbow, Back and Tail,—dark slaty blue. Remainder of Plumage, medium slaty blue, each feather to show lacing of the darker shade as on back.

Plumage of Hen. Medium slaty blue, laced with darker shade all through except head and neck, these a dark slaty blue.

Value of Points of Blue Orpingtons.

Defects in condition	...	...	10
.. ,, Colour and Plumage	...	...	25
.. .. Head	...	...	10
.. .. Want of shape	...	...	25
.. ,, ,, size	...	..	20
,, ,, Legs and Feet.	...	...	10
A perfect bird to count	...	...	100

SERIOUS DEFECTS. Any feather or fluff on legs, long legs, any yellow on legs or feet, more than four toes, side spikes on comb, more than one third white in lobe, any deformity.

BIRD POX (CHICKEN POX).

The following article is taken from a pamphlet published by the U. S. Department of Agriculture and should be of general interest to all breeders of poultry in Ceylon :—

Bird pox is a condition characterized by an eruption of nodules varying from the size of a millet seed to that of a pea, which occurs on the comb, wattles ear lobes, and less frequently on the skin of other parts of the body,

It is more frequent and more malignant in warm than in cold climates, but occurs in most parts of the world. Recent investigations make it probable that it is caused by a filterable virus which is identical with that of diphtheria. As the symptoms of the two conditions are generally quite distinct they are here described separately.

Causation.—Bird pox, so far as is known, does not originate in any other way than by contagion. It seems to be produced by virus from fowls or pigeons affected with either the eruption of bird pox or the false membranes of diphtheria. Experiments have shown that both pox and diphtheria are easily inoculated from fowl to fowl and from pigeon to fowl, but the inoculation of pox to fowl has proved very difficult and that of diphtheria is impossible. The contagion is believed to exist in the blood as well as in the nodules which appear upon the skin.

The disease is generally introduced by new birds which are put into the flock or by exhibition birds which return infected. Probably it is often brought by pigeons, sparrows, and other birds which fly from one yard to another. The inoculation of the comb and wattles appears to occur by rubbing these parts with the infected feet or by being injured with the infected beaks of other birds.

The virus is quite resistant and requires thorough disinfection for its eradication.

Symptoms.—The eruption appears as round, oblong, or irregularly shaped nodules from the size of a pin head to that of a pea or a hazelnut. They are seen especially about the beak and nostrils and on the comb, the eyelids, the wattles, and the ear lobes. In some individuals, and particularly in pigeons, the eruption is more generalised and is found on the skin of other parts of the body, such as the neck, under the wings, on the rump, and about the cloaca. Here the nodules may become larger than on the head.

The nodules begin as small red or reddish-grey deposits with a shiny surface and gradually enlarge, while the colour changes to a yellowish surface and brownish or dark-brown and the surface dries and becomes shrivelled, uneven, and warty in appearance. Owing to the number of nodules and the extension of the inflammation, large patches of skin become thickened and covered with hard, dry crusts closing the nasal openings of the eyelids and making it difficult even to open the beak.

In the milder cases the eruptions are limited to the head, the nodules are distinct and small, and the general health of the affected bird does not suffer The nodules soon dry, heal, and shrink ; the crusts become loosened and fall off, and there is a rapid recovery. In the more malignant cases the eruption is generalised over the surface of the body, the nodules are larger, and there is a diffuse inflammation and thickening of large areas of skin. If the crusts are rubbed or scratched off by the fowls, there occurs from the ulcerous surface a discharge at first watery but later thick, yellowish and viscid, which soils the feathers, and if abundant, gives off a disagreeable odour. This type of the disease is accompanied by fever, rapid loss of flesh, and prostration, and frequently causes the death of the victim. In the most malignant cases, especially with pigeons, the eruption extends to the mucous membranes of the eyes, nostrils and mouth, causing a diphtheritic inflammation that is generally fatal.

TREATMENT.—The mild cases of this disease may be successfully treated by simple local applications. The crusts on the nodules are softened with carbolated ointment, glycerine, or oil, and after an hour or two removed by washing with warm water containing a little soap. The denuded tissue is then treated with a 2 per cent. solution of creolin or lysol, or with a saturated solution of boric acid. Some prefer carbolated oil or carbolated ointment to watery solutions; others apply tincture of iodine. If there is much inflammation of the eyes, apply frequently with a medicine dropper or a pledget of absorbent cotton a solution made by dissolving 1½ ounces boric acid and 1 ounce biborate of soda in a quart of warm water. This solution may be also applied to the inflamed skin either before or after the crusts are removed.

As this disease is contagious, the houses, drinking vessels and feed troughs should be kept disinfected during the outbreak and for some days after all the birds have apparently recovered.

ONION GROWING.

The best way to sow onions is to drill them in although for small areas the seed may be sown in a seed bed, and the young seedlings be planted out. The drills should be from 8 in. to 15 in. apart, which will require from 2 lb. to 10 lb. of seed per acre. The seeds should be dropped at a distance of 2 to 3 in. apart in the drills, and the plants will afterwards require to be thinned out with the hoe to 6 in. apart in rich land. The drills should be slightly raised, and *roots* of the plants be firmly embedded therein. The *bulb* is not the root and it should be allowed, so to speak, to squat on the surface, not under it.

As the plant grows, the soil must be kept perfectly clear of weeds; and where the working of the ground has thrown the soil against the bulbs, it must be drawn down so that only the root is in the ground. Where this has not been attended to, the remedy for the resulting want of bulb-formation is to wring the necks of the plants, or, at least, to bend them down with a twist. This will have the effect of inducing the formation of bulbs.

When sowing the seed, it need only be put just under the ground, as it requires but a very slight covering of soil. If sown deep, many seeds fail to germinate, and most of those that do appear will make an abnormal growth of neck, causing much labour in drawing away the soil from the incipient bulbs. There are few seeds so annoyingly deceptive as onion seed, as old seed will lose its germinating power, and imported seeds, unless carefully packed in airtight bottles or soldered tins, will scarcely germinate at all. Therefore, it is well to make sure of getting new seed. After sowing, germination should take place in about a week, and the onions comes to maturity in from 120 to 180 days (spring onions in from 60 to 99 days). They may be known to be ripe by the drying up of the tops. As soon as this happens, pulling should be done quickly, because, if wet should come on, the bulbs may start a fresh root action. This, besides making them harder to pull, will seriously impair their quality. After they are pulled, the onions are left in narrow "windrows" to get well dried and ripened, and may then be removed to a dry barn, subject to a free current of air. Should they show signs of heating, they must be at once turned over, and the bad ones picked out during the process.—QUEENSLAND AGRICULTURAL JOURNAL.

ENTOMOLOGY.

SOME NOTES ON XYLEBORUS FORNICATUS, EICHH. (SHOT-HOLE BORER.)

(Continued from p. 139).

Dipterous puparia and larvæ are not infrequently found in the tunnels. Whether they prey on the shot-hole borer colony or not I am unable to say, but if they do the extent to which they do so is practically negligible ; beetles and their larvæ and eggs have been found in many galleries that contained the maggots. Still it affords an interesting case of (symbiosis?)

The maggot may be told from the larva of the beetle by its more pointed anterior end, and by the pair of black mouth-hooks which are protruded and retracted.

It has four, short, pointed tubercles at the anal end ; these can readily be seen from the dorsal surface by the aid of a lens. (It is assumed that all the dipterous larvæ seen have been of one species as the adults that have been obtained from the puparia have all been of one species.)

One of the maggots obtained from the galleries I tried to introduce into an unopened gallery. But as soon as it tried to enter, the beetle, which seemed always to be near the outside, backed out pushing the intruder behind it. Time after time it tried to gain admission but without success I tranferred it to another tunnel, but there also it was repulsed. At last, after I had given the beetle a good poking, the maggot was able to enter. When this gallery was opened some time afterwards only two adult female beetles were found ; the maggot had vanished.

It is clear that the maggot is an unwelcome tenant of the gallery, but it does not follow that it is predaceous on the beetle's progeny. If it merely eats the fungus it is nevertheless an enemy of the colony and may serve to a certain, but a small, extent, to diminish the number of the beetles reaching maturity. The puparium is rather long and narrow and of a chestnut colour. It is ruptured by a horizontal split passing through the middle of the anterior end.

The adult fly is a very pretty insect. It belongs to the *Drosophilidæ* The eyes are reddish-brown. The thorax is greyish with three longitudinal black bands. The abdomen is yellowish-white with four very distinct transverse black bands.

The antennæ are yellow and the arista ends in a fan-shaped structure. The legs are whitish-yellow.

Other foreign insects have been encountered on rare occasions in the tunnels.

In a gallery from which a sour-smelling substance was exuding (it is often in such galleries that the above mentioned *Dipteron* is found) was a dead female shot-hole borer and what may be a *Coleopterous* larva, of a different species from *Xyleborus fornicatus* The segmentation of this larva was well marked, each segment being produced laterally into spinous processes. These spinous processes are much sub-divided on the second and third thoracic segments.

On the dorsum are two longitudinal rows of faint dark spots. In another gallery was a strange-looking larva and pupa. The larva is distinctly segmented and each segment bears long hairs. There is a distinct head and a protrusible organ ventrally on the first thoracic segment (suggesting *Lepidoptera*).

The pupa also is spiny. There is a black patch at the anterior end and on each side behind this a brown club-shaped organ. Two long caudal processes are present. Whether this was a pupa of the larva that accompanied it is impossible for me to say, as I failed to rear them.

In a soft excretion gathered round the entrance to one tunnel Dipterous larvæ, that possessed the power of leaping, were feeding. When disturbed they retreated into the burrow. The gallery in which they occurred contained no beetles.

For some reason or another the tenant had deserted the gallery after completing only a small portion of a circular gallery.

What is the significance of these bad-smelling exudations from the burrows, that are not infrequently met with ?

What change comes over the cell contents of the tea eight months or so after pruning, that serves to attract the fertilised female ? If there is no change why does the attack not begin earlier ? It does not seem to have any well-defined relation to the thickness of the twigs.

If there is a change is it, or is it not, pathological ?

These are problems that are more easily stated than solved.

Xyleborus dispar, an insect allied to the Shot-hole Borer of tea, is a pest of fruit trees in Europe. In *Centralbl. Bakter., Paras and Infekt.*, 2. Abt., XXXVIII, No. 1—6, 1913 O SCHNEIDER-ORELLI has a long paper giving the results of investigations on this beetle.

In the course of this paper he states that he has never found an infested tree that did not shew other primary injuries or disease, e.g., wounds, roots gnawed by mice, prunings, effects of frost.

"All influences sapping the vitality of the tree, even if only temporary, such as root and other pruning renders it more liable to the attacks of the beetle."

This investigator found the leaving of a few twigs unpruned in order, as he says, to regulate the flow of the sap, an effective preventive measure.

"Trees pruned in this way are far less liable to attacks from *X. dispar* and recover more rapidly from the effects of pruning."

In Porto Rico a species of Xyleborus attacks sugar-cane, but, according to VAN DINE, it is preceded by a rind disease due to a fungus, *Melanconium sacchari*.

A species of Xyleborus, *X. pubescens*, attacked orange trees in Florida in the summer following a winter when there had been a freeze.

They chiefly attacked dead wood but some tunnelled into sound wood.

At one time sugar-cane in Trinidad, Barbados and St. Vincent was attacked by a species of Xyleborus.

It was observed that there was an alarming increase coincident with a change in the method of disposing of the crushed cane; it had been the custom of the planters owning sugar mills to *burn* this refuse, whereas now they had changed to using it as manure.

Beetles of this genus are frequently bred from logs and timber and in India at one time *X. perforans* did much damage by attacking beer casks.

MR. A. D. HOPKINS, head of the Department of Forest Insect Investigations of the United States Bureau of Entomology and a foremost authority on this group of beetles, in the course of a letter to the writer states that "as a rule, the species of the genus (Xyleborus) do not attack perfectly healthy plants," and he writes as if our *X. fornicatus* were the only exception known to him.

It is possible that our species forms no real exception and that its presence denotes some weakness in the tea, due perhaps to the frequent prunings, perhaps to the stimulation of vegetative growth over long periods, perhaps to some other cause.

Against such a view it might be urged that the borer also attacks seed plants and plants in the nursery; but this might quite well be of the nature of an overflow.

In this connection it would be of interest to know whether plants grown for seed and nursery plants were attacked in the early days of Shot-hole Borer.

In the light of our present knowledge the only means of control that can be recommended are, from an Entomological point of view (1) *burning* of prunings (2) discovery of, and elimination of, so far as practicable, breeding grounds in plants other than tea (3), cultivation and manuring, (4) prevention, so far as possible, of the infestation of fresh areas.

We have records of the presence of *X. fornicatus* in tea in the undermentioned localities :—

Agrapatnas, Badulla, Dolosbage, Demodera, Dehiowita, Gampola, Galaha, Haputale, Kandy, Kelani Valley, Koslande, Ingiriya, Madulkelle, Maturata, Matale, Namunukula, Peradeniya, Pundaluoya, Pussellawa, Puwakpitiya, Rakwana, Rangala, Rattota, Talawakelle, Ulupane, Urugala, Watawala, Wattegama, Yatiyantota.

A. RUTHERFORD.

STOMOXYS CALCITRANS L.

Stomoxys calcitrans L. is a biting fly that in appearance very closely resembles the house-fly (*Musca domestica*). It is popularly known as the "stable fly" or the "biting house fly."

It is a pest of domestic animals and of man throughout the year in tropical and sub-tropical countries, and in summer and autumn in more northern latitudes.

It bites man, mules, horses, sheep, goats, dogs, cats and even poultry. It plays a part in the transmission of "surra," and has been recently shewn to be a carrier of infantile paralysis.

Occasionally, when climatic conditions are favourable, it is a perfect scourge.

Such a condition of affairs existed in the United States of America in 1912. The writer saw something of this outbreak in Western Tennessee in August of that year. Horses even under shelter went almost frantic. They were never for an instant still. It was a common sight to see cattle standing up to the neck in water.

BISHOPP, in a recent Bulletin of the United States Department of Agriculture gives an account of this outbreak in Texas.

Many horses and cattle were so weakened through loss of blood that they gave up the fight and flies swarmed on to them in countless numbers.

All cattle in the Southern United States have the germs of Texas Fever latent in their blood, and in 1912, on account of the weakening of the animals through the attack of Stomoxys, many cattle developed an acute attack of the fever and died.

Dairymen had their output of milk reduced by from 40 to 60 per cent. while the fly pest was at its height.

In many cases cattle could not be fattened for market, and herds that had been formerly shown at the State Fair were not fit for exhibit.

Liverymen had to discontinue making pleasure drives out into the country.

Farm operations were in many cases discontinued.

Some farmers resorted to night work to try to escape the fly, but the teams, harassed as they were by day, were not equal to night work.

What were the factors that produced such an outbreak?

I quote directly from BISHOPP.—

"A study of the conditions existing in North Texas during 1912 shewed that the flies were breeding to a great extent in straw stacks. Unusually heavy rains occurred in the early part of August and as most of the straw was freshly threshed and had not become settled the rain deeply penetrated the stacks. The straw became heated immediately and formed very attractive breeding places for flies.

"The grain crop of 1912 was one of the largest ever produced in Texas and as the straw was also heavy a great number of straw stacks were present to furnish their quota of the pest. In fact the flies were so numerous around these stacks that many men in ploughing avoided, as far as possible, the portion adjacent to them.

"Although the stacks dried out rapidly on the surface the straw beneath continued moist for several months and flies continued to emerge from these stacks when the straw was not destroyed or when breeding was not otherwise prevented."

The fly has been found to breed in wheat straw, oat straw, rice straw debris left after thrashing flax, horse manure, especially if mixed with straw, cow manure, ensilage especially when mixed with straw.

GREEN in Ceylon has bred *S. calcitrans* from decayed pumpkins, and a nearly allied species *S. plurinotata* from decayed shoots of the Giant Bamboo.

There was a bad outbreak of *S. calcitrans* in Talawakelle in October of last year. The Government Veterinary Surgeon in the course of a letter says :—

"Stomoxys simply swarms in the town. I was bitten repeatedly on the ankles, and through the lace holes of my boots.

"The unfortunate cattle and horses cannot rest a minute."

The egg which is laid in the straw is long-elliptical, about 1/25" in length and of a creamy-white colour. When magnified it shows a longitudinal furrow.

They are usually laid in masses.

The egg hatches in from 1 to 3 days.

The larva is a maggot, widest at the hind end and tapering to the head end.

It is white or pale yellow in colour and about 4/5" long. There is but one mouth-hook.

The stigmal plates—to be seen on the posterior aspect—are black, sub-triangular, well-separated, with three pale areas each containing an S-shaped slit

The larva avoids light and seeks moisture.

In hot weather it completes its growth in about eleven days.

The puparium is formed usually among the material where the larva has fed.

It is reddish-brown in colour and long-oval in shape.

In six days the adult may emerge.

The adult has four black bands running the length of the thorax, and several distinct black spots on the dorsum of the abdomen.

It may be told from the house-fly (*Musca domestica*) by its long, black, shining proboscis which protrudes in front of the head, and by the fact that the two veins which run to the apex of the wing are widely separated at the margin, whereas they come close together in the house-fly.

After taking a meal of blood the flies settle on the walls of near-by buildings or on the leaves of plants in a shady situation.

An adult female has been known to live for 29 days.

The number of generations in the year is not definitely known but it is estimated that in hot climates there may be seven broods in the course of a year.

Of the maggots BISHOPP says :—

"The maggots or larvæ are very susceptible to drying. This is particularly true, soon after they are hatched. Excessive moisture is also detrimental to their development and flooding kills them in a few hours.

"They appear to be able to endure rather high temperatures when abundant moisture is at hand, although the heat produced in manure and straw stacks is often sufficient either to kill them or to drive them outward.

"No doubt the generation of heat within the breeding places stimulates the development of immature forms in the fall and winter months.

"Light is detrimental to the development of the larvæ.

"When placed in bright daylight even though sheltered from the sun, larvæ have never been known to complete their development."

The pupæ are attacked in America by two hymenopterous parasites, and hogs, poultry, certain beetles, robber flies, wasps and spiders are predaceous on the insect in one or other of its stages.

It is a common sight at Peradeniya to see the crow picking parasites off the cattle. When a cow is resting a crow is often in attendance. As soon as a fly settles within reach it is snatched up. The crow even pushes its bill and head into the pinna of the cow's ear in search of parasites. When the cows are feeding the crows are often to be seen perched on their backs or leaping up from the ground to their bellies.

Stomoxys calcitrans, other blood-sucking Diptera, and various ticks occur on the cattle at Peradeniya.

Under the heading of "Artificial Control" BISHOPP has the following :—

(1) Coverings for horses and cattle gave a measure of relief.

(2) No substance to act as a repellent of the flies from stock was found to be altogether satisfactory. None had a lasting effect and some were injurious to the animals.

(3) Use of fly traps recommended, PROF. C. F. HODGE's trap being specially recommended. (Owing to the open structure of the stables, etc., in Ceylon this trap would be of no use here.)

(4) Prevention of breeding and destruction of immature stages. All straw not intended for use should be destroyed by burning or should be scattered over the land. Straw intended for use should be so stacked as to prevent it getting wet.

(5) Stable manure should not be stored but should be taken out and scattered at short intervals. [Every 12 days in Ceylon.] This procedure would also serve to control the house-fly and the horn-fly.

(The latter fly, *Hæmatobia serrata*, *R.D.*, which is a pest of stock in America, also occurs in Ceylon.)

A. RUTHERFORD.

TEA AND CITRUS MITES.

BREVIPALPUS OBOVATUS, DONN.

(SCARLET MITE.)

Brevipalpus obovatus Donn is a common and widely distributed pest of tea. It has been recorded from Hewaheta, Passara, Peradeniya, Watagoda, Maousakelly, Haputale, Mahakande, Galaha, Dolosbage and Ouvahkellie. The writer has seen a good deal of what is probably this mite in the neigbourhood of Peradeniya.

The mite lives in colonies on the under surface of the leaf, and the leaf along each side of the midrib and on the midrib has a brownish or blackish withered appearance. Or the under surface may be covered with brownish patches. Not infrequently the attack is worst near the base of the leaf.

Green records cases where whole bushes have been almost denuded of leaves and even killed as a result of an attack of this mite.

The mites I have found associated with the above type of injury are somewhat flat and move rather slowly. They are broadest in the region of the cephalothorax just caudad of a pair of crimson eye-spots. Thence they taper somewhat slowly to the posterior end, where they are bluntly rounded They are shortly hairy and the majority are of a reddish-brown colour with an oval, crimson area in the cephalothoracic region, and just behind this a blackish area with a short, longitudinal, white band in its centre. The legs are light yellow in colour. I have not observed the red feet mentioned by Green.

The palpi hardly reach beyond the rostrum. The legs are rugose. The margin of the cephalothorax is serrated.

Many are provided with a fringe of six pectinæ-like processes grouped round the posterior end; they arise just inside the margin.

When mounted and examined under the microscope the mites are seen to be of two types. In shape and general build they are much the same. One set has the legs strongly constricted near the base; the pectinæ are present but greatly reduced; the rostrum is short and broad.

In the other set the rostrum is comparatively long and narrow, the pectinæ are prominent and the second pair of legs bear a distinct projection on the outer side near their base.

One such that came under my observation contained an oval crimson body resembling an egg.

Another shewed a group of stout bristles on each leg on the ante-penultimate segment.

The six-legged mites are scarlet throughout.

Numerous white, cast skins occur in clumps. Among them are the broadly oval, shining, scarlet eggs.

These in certain cases are seen to be associated with an empty skin. Apparently but one egg is produced and this is enclosed in the skin of its dead parent.

I have observed the same mite on leaves of citrus.

Watt and Mann seem to have observed a different species from that described above, as they say "larva at first quite transparent but gradually obtained two circular red spots one on either side of the rounded and swollen body."

They give the distribution of *Brevipalpus obovatus* as Assam and Ceylon.

Under the name of *Tenuipalpus californicus* Banks describes a mite that bears a striking resemblance to that described above. It occurs on Citrus in California.

TETRANYCHUS BIOCULATUS, WOOD MASON.

(Red Spider.)

This mite, judging from the number of times it has been recorded does not prove so injurious in Ceylon as the other mites of tea. It has been recorded from Maturata, Gampola, Hewaheta, Kandy, Passara, Peradeniya and Gonakelle.

This mite attacks chiefly the upper surface of the leaves, though eggs are not at all uncommon on the under surface as well.

An early attack of red-spider shews up in brownish spots on the upper surface. In an advanced stage of attack the leaf is marled black and brown. On such leaves the white, globular, hatched eggs are present, but the mites have migrated to younger leaves.

The mites are quite visible to the unaided eye.

They are reddish in front and dark-brown behind. Under a lens the reddish part is seen to be confined to the first two pairs of legs and the part of the body to which they are attached.

The body caudad of this reddish area is of a very dark brown colour and spotted with white.

The third and fourth pairs of legs are yellowish.

An examination under a compound microscope shews that the white spots are in four transverse rows and that from each a white, backwardly-directed hair arises.

Eight of these spots are more conspicuous.

The legs bear long, stiff hairs, and there are two large hairs on the red area of the body.

The eggs are globular, somewhat depressed dorso-ventrally and shining and from each springs a stalk.

Some are pinkish or purplish, others yellowish, but the latter have purplish bands forming a more or less perfect network.

The eggs are scattered over the surface of the leaf.

What is probably the male is a smaller, flatter, more tapering mite of a yellowish-brown colour more or less suffused with black on the anterior and middle regions of the body; it is broadest about midway between the points of insertion of the second and third pairs of legs. In one case that came under my observation several such mites were present, and one was feeding near a female which was about to moult.

No distinct web was present though by careful search a few white strands could be made out.

GREEN records this mite from Camphor and Grevillea and I have found it, or one very closely related to it, in the jungle on *Eugenia jambos*. In this last case there was a distinct web, and a few "guy" threads passed down from the tip of the egg-stalk to the surface of the leaf.

TETRANYCHUS MYTILASPIDIS, RILEY.

I have recently found on Citrus in Ceylon a mite which seems to be the Citrus Red Spider (*Tetranychus mytilaspidis* Riley) of California and Florida.

It was first described from specimens taken from orange in Florida in 1885. Since about 1895 it has been a serious pest in California.

It has also been found on deciduous fruit trees in California and Oregon.

It is stated by Quayle (Bull. 234 Berkeley California, Nov. 1912) to be well adapted to warm and dry regions, while *T. sexmaculatus* Riley, another pest of Citrus, is better adapted to humid conditions.

Whether or not our species is *T. mytilaspidis* it is capable of doing considerable injury.

The leaves show a yellowing of the upper surface while the under-surface is marled with yellow and brown, and under a lens is seen to be dotted with black spots.

(In California the mite produces a pale grey or silvery effect over the whole of the leaf and fruit.)

Numerous white, cast skins, visible to the unaided eye are scattered over the under surface, and there is also a fine webbing present.

The largest and commonest mites present are of a yellowish-brown colour often mottled with black along the sides, with a small crimson eye-spot dorsad of the second pair of legs.

According to Quayle *T. mytilaspidis* is distinctly red in colour. But colour seems to be very variable in mites.

The body is not smooth and shining but somewhat corrugated and provided with long, white, backwardly-pointing hairs. On slide specimens it can be seen that these setæ arise from small tubercles, and this character is said by Quayle to distinguish *T. mytilaspidis* Riley from other members of the same genus, only one other species of Tetranychus having tubercles and that not having been found on Citrus trees.

The female is almost oval in shape.

The male is smaller, ovate, the posterior end being pointed.

He is of a clear-yellow colour throughout or darkish brown caudad of eye spots. His first pair of legs is long, stout and darker in colour towards the extremity.

I observed a quiescent female. The two anterior pairs of legs were folded towards each other in front of the rostrum. Near her stood a male. Next time I came across them the male had climbed on to the female and there it remained, no doubt awaiting the change.

The male shifted his position from one in which the axis of his body was parallel to that of the female's to one in which the axes were at right angles, two pairs of legs resting on the leaf, the other pair enfolding the female.

Though I had them under close observation I missed the first stages of the emergence. When I did observe it, the female had come out from the nymphal skin and the male was underneath her. Presently the male ran off and the female soon followed. In another case, while a male was in attendance as above, he was disturbed by the approach of another mite. He got very excited and ran off.

Comparatively large, shining, translucent, yellowish-white eggs often with purplish areas occur singly. They look globular but are flattened dorso-ventrally. Invariably a fine but distinct web over-spreads them as a tent, the threads extending from the top of an egg stalk to the surface of the leaf.

According to QUAYLE "The egg of *mytilaspidis* differs from that of all other species found on citrus trees by the presence of guy threads radiating from the top of a vertical stalk."

The egg, according to the same writer, is at first uniformly bright red, but when hatched it is perfectly transparent but otherwise appears as a normal egg. He adds that later the red colour becomes localised in particular areas.

The six-legged mites are similar to the adults in shape and also possess distinct eye-spots.

Besides the above species there were present on the same leaves several specimens of a smaller smoother and whiter mite. It is characterised by the presence of two comparatively large, oval, purple spots one on each side of the body near the apex of the abdomen. There are sometimes two more dark spots in the same region.

The abdomen is transversely striated.

There were also present small mites that resembled the males of *Tarsonymus translucens*. They varied in colour from a deep yellow with irregular reddish blotches to a light yellow with opaque white areas.

A white egg of (*T. mytilaspidis*?) was seen to crumple up under the attentions of one of these mites.

Small, oval whitish eggs and oval to ovate crimson eggs of same size were also present.

A mite resembling *Brevipalpus obovatus* was also present.

A. RUTHERFORD.

THE RHINOCEROS BEETLE (ORYCTES RHINOCEROS L.).

In the JOURNAL OF ECONOMIC ENTOMOLOGY for December 1913, MR. R. W. DOANE of Stanford University, California, gives an account of studies made on *Oryctes rhinoceros*, L. in Samoa during May, June and July 1913.

The beetle, he states, was first observed near the custom-house of Apia in the Island of Upolu in 1910. Since then the area of infestation has increased, except to the windward of Apia; the prevailing wind is the north-east trade-wind.

The point of attack is usually close to the base of the leaves between the base of a leaf and the tree or between the bases of two leaves.

According to his observations the curved "horn" of the insect is made use of in forcing an entrance to the tree. "The head is lowered and the horn thrust into the fibre, then as the head is raised the body is drawn forward."

The beetles swallow little or none of the fibre through which they tunnel. The mouth parts are fitted less for biting and chewing than for boring and tearing and crushing. "The inner surfaces of the heavy mandibles do not meet except at the extreme base, the triangular space between them being filled by the maxillæ and the top of the labium. The outer margin of the maxillæ and the labium are furnished with a dense fringe

of rather long stiff bristles, which, with similar bristles on the labrum, serve as a sieve for straining out the particles of plant tissue that are torn loose by the mandibles and the two tooth-like projections above them. The mandibles and their projections tear the tissue of the plant into shreds and the juice which is crushed from it is strained through the bristles with which the mouth is surrounded." No trace of plant fibre was found in the stomach.

As the author points out, this fact has an importanf bearing on methods of control.

The larvæ are found most commonly in old decaying coconut logs or stumps, but they also occur in other rotting wood or decaying vegetable matter.

Cacao pods left in piles in the field afford suitable breeding places, and beetles are attracted to this form of breeding-ground even when the pods have been buried.

Larvæ may occur occasionally in living trees (coconut?) if these have been badly injured.

Pupae are never found in considerable numbers.

Usually they are to be found in portions of the log that are somewhat firmer than that in which the larvæ commonly feed.

Probably they also pupate at some depth in the soil.

The adults are not attracted by lights in sufficient numbers to make trap lanterns of any value in control work.

Treatment of the trees with tar after the beetles had been removed was found to offer only a small measure of relief.

Lysol and lysol mixed with tar were tried but these were found to injure the leaves, especially the young leaves.

Coarse beach sand and also very fine sand were poured into the crowns of the trees, care being taken that plenty lodged at the bases of all the leaves; when the trees were last examined only one so treated had been attacked by beetles, but the interval was considered too short to allow of a definite conclusion being come to concerning the efficacy of these treatments.

When white arsenic was mixed with the sand, the young leaves that were touched by the mixture were injured.

Dusting with arsenic and Paris Green did not prevent several beetles from entering the trees.

Carbon bisulphide killed the beetles but injured the trees especially the young trees.

The author makes reference to the traps, which are described in the December number of the Tropical Agriculturist.

Regarding this method of control he remarks :—

"If the work is carefully done it is quite effective on *well-cleared plantations*, but it is expensive and requires close supervision."

Government has begun to aid the planters to clean up their land. In this connection the author well says.—"The insect is a common foe and it is just as much the function of the Government to protect its subjects from it, as it is to protect them from invasion by another nation."

No insect parasite of the Rhinoceros beetle had been discovered in spite of careful search and breeding experiments.

Of the fungus parasite discovered by DR. FRIEDERICHS he says.—"It has been found attacking a very few of the larvæ on some of the plantations. Under laboratory conditions it can be made to do very good work but so far it has spread too slowly in the field to do very much good."

He concludes that for the present the most effective method of control is to destroy the breeding places of the beetle.

A. RUTHERFORD.

THE HORN OF THE RHINOCEROS BEETLE.

"The horn is present on both sexes and is usually longer on the male than on the female, but many males may be found with very short horns and many females with long horns, so that the sexes cannot be separated by this character. The horns vary in length, from 1·5 mm. to 10 m.m., 6 or 7 mm. being about the average length. The beetles feed on the growing heart in the crown of the coconut trees. They usually enter the trees close to the base of a leaf, crawling down as far as they can between the tree and leaf-stem before beginning to bore. The spiny legs enable the beetle to brace itself firmly before it begins literally to root its way into the web-like sheath through which it usually has to pass before it reaches the hard wood. In doing this the head is lowered and the horn thus thrust forward. The horn becomes imbedded in the tissue of the plant and when it is raised serves as an anchor to hold the insect while it pulls or pushes its body forward with its legs, or while it tears the tissue of the plant with its heavy mandibles. The insect will always root and push its way as deep as it can before it begins to bore. The amount of power it can develop is truly remarkable."—SCIENCE.

TURKISH TOBACCO IN SOUTH AFRICA.

According to the AGRICULTURAL JOURNAL of THE UNION of SOUTH AFRICA the Government experiments on the cultivation of Turkish tobacco in the Cape Province has given very encouraging results. The local demand for this tobacco is about half a million pounds per annum. A Tobacco Growing Co., Ltd., has been formed for developing the industry and a warehouse opened for providing marketting facilities. It is thought that this indicates a promising future for the local trade in Turkish leaf.

DESTROYING STUMPS WITH ACIDS.

THE DEPARTMENT OF AGRICULTURE OF NEW SOUTH WALES having fully tested the value of this method of destroying stumps have arrived at the conclusion that neither dry nor green stumps can be destroyed by the strongest acids. The Agricultural Chemist (Mr. J. C. Brünnich) maintains that the process is not only useless but dangerous.

GENERAL.

LUCERNE.

From Seed-bed to Market.

H. A. Melle.

DURATION OF STAND.

One of the valuable characteristics of lucerne is the long life of a well-grown, well-kept stand. In Mexico it is stated that fields of lucerne have been continuously productive without replanting for over two hundred years; and in the Cape Province an instance is reported where lucerne has been mown successfully for over eighty years. It follows naturally that such a deep-rooted and long-lived plant as lucerne should not come to full maturity the first year. As a matter of fact it is not until the third year that the full crop is secured.

ADAPTABILITY.

While experts have been declaring that lucerne would only grow in certain soils and in certain climates, it has proven its adaptability to nearly all climates and almost all soils. It produces with a rainfall as scant as 14 inches and flourishes with 65 inches. It gives crops at an elevation of 8,000 feet above sea-level, and in Southern California it grows below sea-level to a height of six feet or over, with nine cuttings a year aggregating ten to twelve tons per acre. On the Vryburg Experiment Station five light crops were reaped from the "Arabian" variety, sown March, 1912, on dry lands. The rainfall from December to April, i.e., during the growing period, was 9·86 inches. Mr. W. C. Hunt, of Doornbult, states that he has cut as many as twelve crops in twelve months from lucerne in his garden under irrigation and with a heavy dressing of kraal manure.

While it is true that lucerne may be grown by devoted enthusiasts anywhere, yet it has affinity for certain types of soils, and is mostly grown thereon. These soils are deep, pervious to air and water, well stored with mineral plant food, and somewhat alkaline in their nature. Thus lucerne revels in the arid countries, when water is supplied, because there has never been any leaching of mineral fertility and the land is generally very rich in potash, phosphorus and lime.

Lucerne is certainly a voracious lime and potash feeder. The late Mr. Donald Stevenson devoted nearly eighteen months to investigations in lucerne. Amongst some of his results are the following analyses (see *South African Journal of Science*, Vol. VII., No. 3. Professor Hahn's paper).

"One season's crop would take from one acre of soil:—

Number.	1.	2.	3.
Phosphoric oxide	67 lb.	80 lb.	86 lb.
Lime ,, ...	115 ,,	126 ,,	137 ,,
Potash ,, ...	274 ,,	306 ,,	312 ,,

"The researches of the late MR. STEVENSON yield very interesting results :—

"(a) The growth of lucerne in our sunny climate is much more vigorous than in the moderate climate of Europe, and consequently the amount of mineral constituents, phosphoric oxide, lime, and potash, taken from the soil is very much larger than in Europe.

"(b) The average amounts of albuminoids in our lucerne is larger than in the lucerne grown in Europe and our lucerne-hay is more nutritious than the lucerne-hay from Germany or England."

SOILS ON WHICH IT IS DIFFICULT TO GROW LUCERNE.

Any soil that is not more than three feet above the water line is too shallow for continued lucerne growth. On barren sands it is doubtful if it is worth while trying to establish lucerne fields. They must be continually fed in order to produce this forage, so rich in mineral elements, which mineral elements, it must be remembered, must come from the soil.

SOILS ON WHICH LUCERNE WILL NOT GROW.

There are just two soil conditions that seem absolutely against the growth of lucerne. The first is a state of constant wetness. Lucerne will not stand "wet feet." This invariably smothers the plants, in fact it usually kills any crop. The other kind of soil in which lucerne refuses to grow is one in which there is too much acidity. This is often the case where mealies and wheat have been raised for many years, thus robbing the soil of much lime—a condition that may be remedied by an application of lime to land just before sowing the lucerne. I do not believe that our sour veld will prove very satisfactory for lucerne growth. MR. J. E. WING, one of the greatest authorities on lucerne in America, holds that, to grow lucerne successfully, one requires lime, drainage, humus, and inoculation (here enumerated in the order of their relative importance).

ROOT SYSTEM.

The mere mechanical effect of the extensive root system can scarcely be over-estimated. As soon as germination begins, the plant starts its tiny roots downward in search of moisture. Roots four feet long have been found on lucerne four months old. On examining the roots of lucerne fifteen months old, grown at the Vryburg Experiment Station, it was found that they had gone down over four feet and penetrated through a hard layer of lime formation. The formation was so hard that it was scarcely possible to make any impression on it with a crowbar. Lucerne roots have been known to go down as deep as 139 feet.

After the tap root reaches a few inches below the surface, it sends out smaller roots that have a lateral growth of but a few inches when they, too, take a downward course for moisture and for mineral elements needed for the growth above. These first smaller roots decay and others start out from the tap-root lower down. These decay and still others start. The lateral rootlets evidently die off when they have exhausted the surrounding soil of the mineral constituents the plant requires. The decaying roots add humus to the soil and the openings left by them form a wonderful system of channels for the penetration of air and water into the soil.

An advantage possessed by lucerne and other leguminous crops is that they are not dependent on the soil for their nitrogen supply, but are able to utilise the free nitrogen of the atmosphere. It is a bacterium present in the soil which enables them to use the atmospheric nitrogen : and these bacteria form little wart-like nodules on the roots. DR. SOMERVILLE states :—"In some way or another, these organisms can evidently lay hold of and work up into organic compounds, the free nitrogen and afterwards hand it on to the

plants on which colonies have established. This association of two organisms for the mutual benefit of both is not uncommon both amongst plants and animals In the case we are considering the leguminous plant offers, as it were, house-room to the bacteria, which in return for the accommodation thus provided, convert the free nitrogen into such a form that it can be appropriated by the higher plant." The absence of nodule formation handicaps the plant seriously, for then the lucerne becomes dependent on soil nitrogen like any ordinary farm crop.

A number of observations have been made at Vryburg in search of these nodules on the roots, but none have yet been discovered. This is evidently due to the lucerne not being allowed to run to seed, and to the fact that nodules are said to form only after the plant is two years old. On the other hand, experiments conducted at the Grootfontein School of Agriculture show that lucerne six months old, which has not yet reached the flowering stage, has a great abundance of nodules present on the roots. On the plot adjoining the lucerne experiments at Vryburg some cowpeas were grown, and their rootlets had a number of nodules, which were noticed only after the plants came into seed. Mr. Burtt-Davy writes :—"In the Transvaal lucerne fields I have rarely been able to find many bacterial nodules present in the roots, and often none at all. The largest crop of them I have seen was in the field of the Hon. J. A. Neser, m.l.a., at Klerksdorp, in a moist, light, sandy loam. On transplanting some of these plants, together with a good deal of soil surrounding them, to the Botanical Experiment Station, Skinner's Court, Pretoria, the lucerne grew, but the old nodules gradually disappeared, and very few new ones could be found." An instance is known where a certain plot of lucerne was repeatedly cropped just about the budding stage. After a while the lucerne seemed to make very poor and slow growth. It was allowed to run to seed and after that it made vigorous growth. It is intended to ascertain the effect of allowing lucerne to go to seed and then examine the rootlets for an increase of nodules

The establishment of a good stand of lucerne is dependent on three essentials ; the man, preparation of the ground, and using the best quality of seed for sowing.

PREPARATION OF THE GROUND.

Many of the most successful growers begin their preparations two or three years before they sow their seed. There ought to be the most perfect physical condition of the soil. In preparing the land for lucerne intended to be irrigated, the ground should preferably be divided into beds. The beds should not slope so much as to cause erosion or allow the water to run over the surface without penetrating it more than a couple of inches ; nor should it be a dead level, as drowning will take place in such spots. A gentle fall is the most suitable, ensuring sufficient penetration and at the same time causing no unnecessary wash and lodgement of water.

It must be remembered that lucerne in its early stages is a very delicate plant, hence the necessity for taking every precaution to have a deep and fine tilth and to give the lucerne a good start over its enemies. Under any land conditions as in Bechuanaland, almost any crop, except the sorghums, kaffir corn, and melons, may be grown to precede lucerne for the next season's sowing. The three crops mentioned should not be sown, as they take out too much moisture. In this part of the country, if possible, put on a liberal dressing of manure the preceding winter ; plough deep in the spring and work to a fine tilth for the summer. As cowpeas do so remarkably well in Bechuanaland, they may be strongly recommended as a preceding crop. Cowpeas are a valuable forage, the hay being worth almost as much, pound for pound, as that of lucerne.

To summarize the above, work the land for two or three years before sowing lucerne. Apply a good dressing of manure the preceding winter. Plough deep the following spring and sow cowpeas as a preceding crop. Plough deep again, and work the fallow during the summer until the time for sowing.

Ploughing just before sowing is not recommended, as this causes loss of moisture and leaves the ground in too loose a condition. Good tilth is required, but at the same time the soil must be compact enough to give the rootlets a firm footing.

SEEDING—TIME TO SOW.

In America sowings are always made either in early spring or late autumn. In South Africa most of the successful growers recommend sowing during the rainy season. It just comes to this, that sowing must be done when the ground is in a fit condition to receive the seed and the climate such that it will start the plants to grow vigorously, but at the same time assist in keeping down weeds. For Bechuanaland sowing in March is recommended, as by that time the weeds are harmless, having passed their prime, and if fallowing is practised we should have sufficient moisture to start the seeds germinating. The hot days—and some rain can generally be relied upon in March—will give the plant sufficient growth before winter sets in.

RATE OF SEEDING.

This will depend on many conditions, e.g., vitality of the seed, condition of the surface soil, condition of the sub-soil as to moisture, the method of sowing, weather conditions at the time of sowing or immediately after and also the natural fertility of the soil. For broadcasting in South Africa, the quantity ranges from 18 to 20 lb. per acre. With a good quality of seed, a suitable soil, and climatic conditions, 15 to 18 lb. is recommended.

SELECTION OF SEED.

It is of the utmost importance that great care be exercised in the selection of seed. It should make an attractive market sample and exhibit high power of germination. It should be a clean sample and guaranteed free of all impurities and parasitic weeds, such as dodder. Care should be taken to obtain the peculiar variety of plant desired ; that is, the seed must be true to name ; in this country it is often necessary to rely solely upon the honesty of the vendor.

Other things being equal, seed of high germinating power is usually cheapest, because a less quantity is required and the resulting plants are usually stronger and more vigorous. A sample of seed of low germination capacity is usually in this condition, either because it is immature—that is to say, insufficiently ripened—or because it is too old, or because it has "heated" in the stack at some other period of its history. This poor quality seed will produce plants so feeble as not to survive the first few weeks, or it may be days, especially under adverse conditions.

METHODS OF SOWING.

Broad-casting is most universally practised both in South Africa and America, although the experiment stations in America recommend drilling in preference to broad-casting. The advantages of a drill are, a more even distribution and uniform covering of the seed, also a more uniform distribution of soil moisture. The general opinion is that by sowing with a drill one will use much less seed. For seed purposes, in America, on dry lands, lucerne is drilled in rows three feet apart and cultivated the same as mealies. The lucerne at Vryburg is drilled in rows two feet apart at the rate of 8 lb. per acre. Two feet between the rows is found sufficient for inter-cultivation. MR. G. J. BOSMAN, Lecturer on Agriculture, Grootfontein School of Agriculture, who has had personal experience on a lucerne ranch in the Western Dryland States, America, says that "they also sow broadcast with good results. Of course every care is taken in conserving as much moisture in the seed bud as possible to ensure germination."

NURSE CROP.

Many people will practise the method of sowing their lucerne with a nurse crop. These people, it is feared, overlook the fact that, by having a nurse crop, they cut off the rays of the sun from the lucerne. Lucerne is essentially "a child of the sun." Besides, lucerne, when young is very easily smothered by other plants. Only under certain exceptional conditions, such as to prevent erosion, etc., under irrigation, is there any sufficient reason for practising this method.

IRRIGATION.

Whenever it is possible to do so, lucerne should be sown under a well-laid-out irrigation scheme. The best results have always been obtained under irrigation. Although lucerne responds very readily to the practice of irrigagation, yet this method can be abused. It is an established fact that lucerne, in its very young stages, generally gives better results if not irrigated. The germination and stand of lucerne are generally found to be better when brought up by rain. By having the surface too wet at the time of sowing a crust forms and evaporation sets in so rapidly as to be detrimental to germination and to the growth of the young plants. Lucerne should, if possible, not be irrigated until it has attained a growth of a few inches, weather permitting, say about six to eight weeks after sowing. WILLCOX, in his "Irrigation Farming," says :—"The critical time with alfalfa is the first six weeks of its growth. Flooding during that period is quite certain to give the plants a backset from which they seldom fully recover before the second, and sometimes not before the third year, and it is not often in the arid States that rain falls with sufficient frequency to dispense with the necessity for irrigating the plants while small. By soaking the earth from thirty-six to forty-eight hours before seeding, however, the plants will make vigorous growth until they are ten to twelve inches high, after which they may be irrigated with safety. When alfalfa has become established a single copious irrigation after each cutting will ordinarily be found sufficient to ensure a crop.

CULTIVATION.

There are many useful implements on the market for cultivating lucerne. It is suprising to see what an amount of cross-cultivation lucerne can stand. During the last year's drought at this station four and five months' old lucerne was cross-harrowed as often as five times. The lucerne withstood the drought remarkably well, whereas in the adjoining plots a number of indigenous and foreign grasses all succumbed (with the exception of *Phalaris bulbosa*), although they received better treatment in that they were cultivated between the rows. Very good results have been obtained by discing. Discing splits the crowns, which tends to make the plant stool more.

VARIETIES.

The principal varieties grown in this country are Provence, Arabian, Tamworth, Hunter River, Peruvian and Turkestan.

Provence is the best known and has been cultivated with universal success for a number of years.

Arabian is a comparatively new introduction, but has made rapid strides during the last two years and is now very popular. This variety is much thought of in America. It grows quicker, bears more crops per sea on, and grows in a lower temperature than ordinary lucerne. The leaves are thinner, larger, and more hairy. The stalks, when green, are very succulent. Horses and vermin, such as hare and buck, seem to prefer it to the other varieties. Owing most probably to its vigorous growth it does not appear to be affected so readily by insect pests.

Tamworth and Hunter River.—MESSRS. C. STARKE & CO. comment as follows :—"Tamworth and Hunter River probably differ only to a very small extent as they are grown in districts which are not very far apart, but the Tamworth variety is grown at a greater altitude than the other, and for this reason it possibly may be found superior for many districts where lucerne is grown at a high altitude. These two varieties, as well as Arabian, stand the cold very well and often give a fair amount of growth in mid-winter."

Peruvian is very similar to Arabian. It is characterised by its long-growing season and lack of hardness.

Turkestan has been tried to a considerable extent, but very few report favourably on it. It is a very slow grower, although at Doornbult three cuttings were obtained from it last season. It stools well along the ground and has a great deal of leaf surface.—SOUTH AFRICAN AGRICULTURAL JOURNAL.

(*To be Continued.*)

CAN SELECTION IMPROVE THE QUALITY OF A PURE STRAIN OF PLANTS?

C. HAGEDOORN AND A. HAGEDOORN.

It is generally claimed by seed-merchants that continued selection gradually improves varieties of agricultural plants, and that unintermitted selection is indispensable to keep their quality up to standard. The majority of people believe that, as soon as selection ceases, the variety will begin to deteriorate. It is for this reason that a high price is paid for seed of a good variety to the man who either originated the variety or who continues its selection. In the case of some plants only the seed which leaves the hands of the seed merchant is used, while in other cases the seed is grown for two or three generations. In the latter case the value of the seed drops lower with each generation.

It is evident that it is of the utmost economic importance to know how far this belief, that unselected seed deteriorates, has a foundation in fact.

The qualities and characters of each individual plant result from the whole development of this individual, and this development we now know to be, in its turn, the result of a great number of causes or factors. Some of these factors we know to influence the plant's development from the outside, such as light and water and salts, but we also know that there are other factors which control the development of the plant and which must be transmitted through the seed from one plant to its daughter-plants. It is these transmitted factors which are responsible for the permanent differences observed between plants of different varieties, and these differences remain even if plants of the two varieties are grown under the influence of identical environment. We now know that the difference between a hairy and a glabrous wheat-plant is due to the presence, in the seed from which the former grows, of an inherited factor which is not present in the seed from which the latter grows. We now know also that in respect to such inherited factors a plant may be either pure or impure. It is pure if it inherited the factor in both halves of its germ, impure if only in one. If it is pure, all its seeds will be pure. If it lacks the factor, all its seeds will lack it. If a plant is impure for any inherited factor, we have a complication. Some of its seeds will give plants which are impure, but some of its children will ack the factor, and others will be pure in regard to it.

If we start with one single plant about the developmental factors of which we know nothing, it may, in respect to given factor, X, be pure, or impure, or it may be lack X. In the first and last cases all its descendants will in respect to X be identical. They all have it, or they all lack it. If it be impure for X, only half the number of its children will be impure ; of the rest, some will be pure, some will lack it. If, therefore, we choose one-daughter plant of our plant at random, we have, even if this last were impure, a 50 per cent. chance that the daughter-plant will not be impure in respect to X. By continuing to take one daughter-plant in each generation, in very few generations our strain becomes automatically pure for all the genetic developmental factors it contains. This is of course only true if no crossing occurs. In self-fertilizing plants continued selection of one plant in each generation automatically makes a strain which is pure for all inherited factors, no matter how impure the plant we started from may have been. About 1850 LOUIS DE VILMORIN empirically discovered this principle. In the breeding of self-fertilized plants, his procedure of taking only one plant in each generation is now of almost universal application. A strain, which has been so bred is, as we saw, pure for all its inherited factors. If, therefore, selection could still alter its qualities, this would prove that selection could alter the quality of the individual inherited factors.

Can selection do this ? Has selection any effect on a pure strain, or is such a pure strain unalterably pure as long as no crossing occurs ?

JOHANNSEN has shown, in breeding experiments with beans, that such strains are really absolutely pure, and that selection in such strains has no effect whatever. Selection or no selection, the strain retains intact its inherited constitution.

Some authors have stated that in their opinion these selection experiments of JOHANNSEN are inconclusive, because of the small number of generations during which they have been made. They thought it possible, that even if no effect of the selection were felt in two or three generations, in ten, or twenty, or thirty generations the steady influence of selection would make itself appreciable. It is evident that it is not an easy matter to put this idea to the test. Such experiments would take too long a time. But they are happily also superfluous, for such experiments have been made on a big scale. Some sixty years ago, about 1843—1850, LOUIS DE VILMORIN started growing different varieties of wheat. He made a collection of the most important commercial varieties of his time, and when he procured a new one, he put an ear away as a sample, labelled and dated. From this original plant he selected one single daughter plant, from this again one and so on. The collection has been added to by himself, and later by his son and his grandson, until now it comprises about 1,800 varieties. The original specimen ears, kept by LOUIS DE VILMORIN, were re-discovered in a drawer by M. MEUNISSIER, the genetician of the firm of VILMORIN, in 1911. Every one of these ears was dated and labelled by LOUIS DE VILMORIN, and, though somewhat browned by age, was preserved in excellent condition. We took one dozen of these specimen ears and compared them with the corresponding specimen ears of the 1911 harvest. In each case the new ear is from a plant which is the direct descendant of that from which the old one is taken. Half a century of selection lies between them. In long-eared plants, the plant with the longest ears was continually chosen, in compact-eared varieties the plant with the compactest ears, and so on. In no respect has this long-continued selection been able to effect a change.

Once a strain is pure for all its genetic factors, is it possible to grow its seed without selection for a great number of generations, without fear of its deteriorating ? Assuredly it is, provided the strain *is* pure. Wheat, or barley, which has been rendered pure by individual selection and of which every

plant descends from one individual plant some generations back, can be grown for as long as it can be kept free from admixtures. If a seed-merchant sells a mixture, in which some seeds, even a small minority, belong to a strain which does not quite come up to the standard, this seed cannot be multiplied indefinitely, for there is the risk that plants of the inferior strain may take the upper hand.

Seed of self-fertilized plants, which has been derived from one single plant of a pure strain, by some generatious of multiplication, is as good after ten or twenty. as after three or four generations when it leaves the seed-merchant. There is really no excuse at the present day for seed-merchants to sell anything but seed of this absolute purity.

Wheat, or barley, or oats can be of so pure a strain that no amount of selection can possibly ameliorate them, no amount of selection in the other direction can deteriorate them.

On the other hand, in the case of habitually cross-fertilized plants, such as rye and beet, continued selection by experts is most necessary in order to keep the quality of the seed up to standard, as under practical conditions no really pure strain can ever be produced by such plants. In these plants the seed deteriorates by multiplication without selection, and it is very probable that, by an unwarranted generalisation, it has come to be believed that the same holds true for all agricultural plants.—JOUR. OF THE BOARD OF AGRICULTURE.

EXPLOSIVES AND TEA CULTIVATION.

TO THE EDITOR OF THE TROPICAL AGRICULTURIST.

DEAR SIR,

With reference to the article which appeared in the "TROPICAL AGRICULTURIST" for October headed as above, we hand you a criticism sent by our Principals MESSRS. NOBEL'S EXPLOSIVES CO., LTD., Glasgow, which we shall be pleased if you will publish, in view of the effect the article referred to might have on your readers, who are users or probable users of Explosives for Agriculture.

Thanking you in anticipation

Yours faithfully,

For BOSANQUET & CO.,

A. B. RICKETTS.

Colombo 7th January 1914.

(*Criticism referred to.*)

With reference to the article which appeared in "THE TROPICAL AGRICULTURIST" for October headed as above, we think that certain remarks dealing with the liability of High Explosives to explode by spontaneous combustion are misleading in the extreme, and indeed inaccurate.

To begin with, great precautions are taken in the storage of High Explosives in the Tropics, and these compounds are therefore never subjected to exposure for a long time at an elevated temperature. All our High Explosives sent to the Tropics are certified by an Inspector of Explosives to be perfectly safe to transport, store, and use in the atmospheric conditions prevailing in the Tropics.

We need only point out the remarkable freedom from accidents of any kind caused in the transport or storage of High Explosives, and especially so in India. We do not attach much importance to the explosion of two

magazines at Aden in 1888, as, even if this were due to decomposition of Explosives—which is doubtful—a very great deal has been learned since then regarding the methods of stablishing Explosives.

It is not correct to say that Nitro-glycerine compounds are more dangerous in storage than Gunpowder. In fact, it is very difficult to get buildings in which Gunpowder is stored free from the dust of the material, which is very easily ignited. On the other hand, suitable buildings can be erected for the storage of High Explosives, and, owing to the nature of the compounds, there is no danger of loose material lying about.

We think that, in view of the effect an article such as that which appeared in the "TROPICAL AGRICULTURIST" is likely to have on the use of explosives for agricultural purposes, it is desirable that the statements made should be contradicted. Persons interested in mining and such works know the benefits of using High Explosives, but it should be borne in mind that, for agricultural work, the use of Explosives and their nature are not so well known and consequently prospective users might be misguided by the article referred to.

[The passage complained of by our correspondents was from a paper in the QUARTERLY JOURNAL of the Scientific Department of the Indian Tea Association quoted by the INDIAN AGRICULTURIST. By not quoting the whole of the passage our correspondents miss the point themselves and are apt, we think, to mislead others. The sentence is as follows: "Amongst other points noted by the writer is the well-known fact that nitro-glycerine compounds are more dangerous in storage than is gunpowder, as they are liable to spontaneous combustion from being exposed for a long time to an elevated temperature, which sets up a chemical decomposition." The point we think here is not whether great precautions are taken in the storage of high explosives in the tropics but whether nitro-glycerine is liable to decompose at an elevated temperature. As it so liable, it was obviously desirable to offer a warning.—ED. T. A.]

CONTROL OF THE WEATHER.

ELECTRICITY AND PLANT LIFE.

Before the Institution of Electrical Engineers last night the annual Kelvin Lecture was delivered by Sir Oliver Lodge.

The LECTURER, who took for his subject the electrification of the atmosphere, said that in normal circumstances in fine weather the earth was negatively charged and the higher layers of the atmosphere positively charged. Lord Kelvin had held the view that fine weather was associated with the positive condition of the upper atmosphere, and it was the fact that the electrical conditions were reversed in cloudy and rainy weather. If these things were associated as cause and effect, that gave birth to the hope that a control of the electrical conditions of the atmosphere might be the proper line of research to follow in any attempt to control the weather. That in many parts of the British Empire it was desirable to control the air would be generally admitted. He could not help thinking that the well-known influence of ultraviolet light in coaxing the negative electricity of the earth into the lower air whence it was carried by wind currents to a higher level produced the conditions which caused thunderstorms. Further investigation of the upper atmosphere was necessary; now that both North and South Poles had been discovered there was a fairly complete knowledge of the electrical condition of the surface of the earth. Experiments ought to be

carried out as to the effect in countries where rain was wanted of flying kites at a high elevation and by that means discharging into the clouds sufficient electricity to start a rainfall.

The application of high-tension current to the growing of crops had over a series of years in Worcestershire given about 30 per cent. increase in the crops in comparison with areas to which artificial stimulation was not applied. In fine weather seasons there was no need to supplement the ordinary electrification of the atmosphere. The botanical effect of electricity on plant life was now being carefully investigated at Leeds University and elsewhere.—THE MAIL.

THE VALUE OF SUGAR.

In a comment on the multiple uses of sugar, THE LANCET points out that the fact that sugar is a cheap carbohydrate containing a rich proportion of carbon, and that it acts in some cases as an acid, forming definite and soluble compounds with the bases, renders it a useful agent in certain industrial processess. It is, for example, the foundation of common boot blacking. To some extent this has been replaced by wax and fluid polishes, but the old blacking made from sugar is regarded by many authorities as holding its own both as a polisher and preserver of the leather. Sugar is also employed in the manufacture of leather in order to remove the lime used as a scourer of the hides. Sugar enters largely also into the composition of copying inks, and printers' rollers are made up of a mixture of glue and glycerine or sugar. It is used also as a cheap substitute for glycerine or alcohol in the manufacture of transparent soaps. Sugar, again, forms nitro-compounds, and hence a series of explosives owe their potentialities to the association of sugar with nitric acid. For a long time sugar has been employed as a hardener and strengthener of cements, and to this day is mixed with mortar to give it permanently hard qualities. Plaster is similarly treated with the same object. Some of the most ancient masonry of the world has been found to contain very appreciable quantities of sugar. The world thus owes a debt to sugar quite apart from its merits dietetically or as a preservative of foods. Its function as a preservative is not less important than its value as a nutritive, and, apart from being directly a food, sugar serves to stimulate the flow of the gastric juices, and so acts in a way which recalls the action of soups or meat extracts. All these considerations are interesting as illustrating the number of ways in which sugar serves, apart from that of being a direct nutritive in the common dietary.—THE GROCER'S JOURNAL

MEDICINAL PLANTS IN HUNGARY.

PEPPERMINT.

Peppermint (*Mentha piperita*) is cultivated in several regions of Hungary on greater extents of land. The dried leaves (*folia menthæ piperitæ*) are used for infusions, while menthol and the essential oil of peppermint (*oleum menthæ piperitæ*) are still more used. The value of this plant depends upon its menthol content. In this respect Hungarian peppermint is superior to American, for while the former contains 42·88 to 55·9 per cent. of free menthol and 55·38 to 65·19 per cent. of total menthol, the American peppermint contains 40 to 45 per cent. of the former and 59·6 per cent. of the latter.

Peppermint is cultivated in the Great Hungarian Plain (Alfold), as well as in the north of Hungary and in Transylvania. It is exported in great quantities to Austria and Germany; in 1912, however, the trade in this drug was not so brisk as in curled mint. Peppermint yields from 7 to 10 cwt. of dry herb per acre worth about £1 14*s* to £2 2*s* per cwt., so that the gross returns from an acre range from £12 to £21.

BALM.

Balm (*Melissa officinalis*) is grown in some dry localities of Hungary. At the station the cultivation of this plant has succeeded admirably and the farmers of Upper Hungary and of the Alfold have obtained good results. On the whole it may be said that Hungary produces a fine and very aromatic balm, the climatic conditions of our country suiting it very well. It is not consumed to the same extent as the mints. According to experiments made at the station, a revenue of about £23 per acre, after deduction of the cost of labour, may be expected from it.

SAGE.

Sage (*Salvia officinalis*, grows in similar conditions and is cultivated in gardens. It is a native of the South of Europe, where it grows wild. and whence great quantities are sent to the markets of the world. Though it is exported from Italy and Dalmatia at a very moderate price, its cultivation is profitable, as the cultivated plant is more esteemed.

CLARY.

Clary (*Salvia sclaria*) is also grown in Hungary. Its flowers and leaves are in great demand for their strong smell and aromatic flavour and are used especially for doctoring wines. Most of it goes to Germany.

SWEET MARJORAM.

Sweet marjoram (*Origanum Majorana*) is being increasingly grown in Hungary. It is sent to the Austrian, German and French markets. In Paris the celebrated marjoram of Provence has been compared with the Hungarian product and the latter has been found the finest and most aromatic. It has thus a great future before it in Hungary, especially on the right bank of the Danube and on the Alfold, where it is most cultivated. Marjoram can yield a profit of £12 per acre.

HYSSOP AND RUE.

Hyssop (*Hyssopus officinalis*) and rue (*Ruta graveoleus*) thrive well in the dry parts of Hungary, especially on the Alfold, as they are very drought resistant. According to the experiments carried out at the station, they can yield a yearly income of £11 5*s*. to £22 10*s*. per acre; nevertheless these two plants occupy a very subordinate position in the trade. Most of the exportation is to Austria and Germany.

Several large estates in Hungary grow coriander (*Coriandrum sativum*). Recently, Hungarian coriander has become an important factor in the trade, in which formerly Thuringian and Moravian corianders were predominant—MONTHLY BULLETIN.

THE CEYLON AGRICULTURAL SOCIETY.

Minutes of a meeting of the Board of Agriculture held at the Council Chamber at 12 noon on Tuesday, the 3rd February, 1914.

HIS EXCELLENCY THE GOVERNOR presided,

The following were also present:—Hon'ble the Colonial Secretary, Hon'ble Sir S. C. Obeysekere, Sir Solomon Dias Bandaranaike,

Dr. H. M. Fernando, Dr. A. J. Pearson, the Rev. Father Paul Cocreman, the Rev. Father Le Gock, Messrs. James Peiris, F. M. Mackwood, Herbert Inglis, G. W. Sturgess, M. Kelway Bamber, D. S. Corlett, T. Petch, G. Bryce, A. Bruce, H. L. De Mel, W. A de Silva, Francis Beven, J. D. Vanderstraaten, A. W. Beven, H. Amarasuriya, Mudaliyar A. E. Rajapakse, F. L. Daniel, A. Rutherford, the Director of Agriculture, and Mr. C. Drieberg (Secretary).

Visitor.—PROFESSOR WYNDHAM R. DUNSTAN.

The minutes of the previous meeting were read and confirmed.

The Progress Report, which was circulated, was taken as read and adopted.

Statement of Accounts to end of 1913 was tabled.

H. E. THE PRESIDENT welcomed PROF. DUNSTAN.

THE SECRETARY read extracts from his report on the Coimbatore Agricultural Conference. MR. BAMBER and DR. FERNANDO offered remarks and the DIRECTOR OF AGRICULTURE proposed a vote of thanks to the SECRETARY for his paper. This was seconded by Mr. JAMES PEIRIS and carried.

THE SECRETARY brought up the question of raising the rate of local subscription from Rs. 8/- to Rs. 10/- and the foreign rate to Rs. 15/- per annum. In return the members would get a free copy of the Society's Year Book and an enlarged Journal with contribution from the members of the Staff of the Agricultural Department. MR. A. W. BEVEN seconded and suggested that a supplement of articles from the local press on subjects of special interest be added for purposes of reference. MR. VANDERSTRAATEN approved of MR. BEVEN's suggestion. The resolution was carried.

PROFESSOR WYNDHAM R. DUNSTAN, Director of the Imperial Institute, who was present as a visitor, addressed the meeting on the subject of the INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE in London to be held next June. He invited members of the Board to contribute papers and suggested that Ceylon should appoint delegates to the Conference. MR. LYNE, Director of Agriculture, proposed and it was agreed to contribute a sum of Rs. 150/- towards the expenses of printing the proceedings of the Congress.

MR. LYNE also referred to the forthcoming RUBBER AND ALLIED INDUSTRIES EXHIBITION to be held in London about the same time and proposed that the Society make a contribution of Rs. 250/-. This was approved.

MR. LYNE further referred to the proposed COLLEGE OF TROPICAL AGRICULTURE. He announced that the local committee had met PROFESSOR DUNSTAN in consultation, and referred back certain points to the London Committee for reconsideration.

The meeting concluded with a vote of thanks to the Chair.

C. DRIEBERG,
Secy., C. A. S.

SELECTING LAND IN THE TROPICS.

WOLTMANN.

The writer has often had occasion to observe that the lack of success of plantations had been due to errors in the selection of the land.

When a farmer intends utilising virgin soil for a plantation he should in the first place examine with attention the vegetation on it and the forms that it assumes; as the vegetative conditions of a district depends chiefly upon the climate, it may be said that the susceptibility to cultivation of a soil is determined in the first place by climatic conditions and of these the prevailing factors are temperature and rainfall.

Within the limits set by climate, the soil with its various properties becomes the decisive factor. In the first place there are the ecological factors in general and then the geological ones.

From the point of view of the latter the origin of the soil has to be investigated, that is from what rocks and by what process of decomposition it has been formed ; thus there are red soils, yellow soils and laterites widely spread in the tropics. Further the distinction between the sedentary and transported soils must be noted. The study of the subsoil is also very important, especially from the point of view of moisture conditions.

CHEMICAL ANALYSIS.

In chemical analysis the first step is the investigation of lime content, which is to be done on the spot, using hydrochloric and not acetic acid. Arid soils in the tropics are very rich in lime, while moist ones contain very little of this element.

Now certain crops require lime: such as coffee, sugarcane, and among Leguminoseæ, specially earthnuts; other crops are more or less indifferent; thus maize and sorghum thrive in washed-out soils containing a minimum of lime.

In general, the writer believes that a tropical soil may be considered good and suitable for a plantation from the point of view of its capital in fertilising substances, when it contains :

Soluble in cold hydrochloric acid :

Lime Magnesia	...	...	0·2 to 0·5 per cent.
Potash	...	...	0·1 ,, ,,
Phosphorus Peutoxide	...	...	0·1 ,, ,,
Nitrogen	...	...	0·1 ,, ,,

The following form is proposed for the chemical analysis of tropical soils.

The determination of the absorbent power of the soil is important, especially in connection with the prevalence in the tropics of red and yellow soils possessing a marked power of absorbing ammoniacal nitrogen and with the abundance of nitrogen in the rainfall of the tropics ; thus a yearly rainfall of 120 inches brings down 72 lb. of nitrogen to the acre.

As for bacteriological properties the writer has observed the development of Leguminosæ without nodules ; nevertheless the practice of inoculation in spreading their cultivation may turn out favourable, especially for soy beans and earthnuts.

CROP REQUIREMENTS.

Turning to special crops, it may be said that *cacao* requires deep, warm and soft soils, rich in nutritive substances, especially potash, and not marshy. *Coffee* requires in the first place a soft soil, moderately moist and rich in plant food, so that it does not thrive on poor sandy soils or on lateritic ones. *Nutmegs* are very exacting as to soil, which must be of the best, and climate, which must have a uniform temperature from 69 to 90° F. and much rainfall. *Vanilla* demands humous soils, moist composts rich in plant food. *Sisal hemp* is suitable for those districts where the conditions of moisture are not of the best, being satisfied with 12 to 20 inches of yearly rainfall. *Cotton* grows on all kinds of soils excepting peaty or purely sandy ones ; nevertheless, account has to be taken of the subsoil and of the climate, and varieties must be selected which can avail themselves of two or three months' rain. *Jute* wants moist alluvial soils. Rubber has no special requirements, save for the fineness of texture, which maintains that moisture which seems to favour greatly the formation of latex. *Tan acacias* prefer the dry soils of arid regions. *Earthnuts* like deep and soft soils, never too moist, with sufficient lime and enough water for growth during the first few months. *Palms* behave differently according to their species : thus *coconuts* thrive on all soils except those containing stiff clay either on the surface or in the subsoil ; the best are sandy coral soils and basaltic soils, even if rocky, provided they have not

THE DATE PALM

An easy and well paying culture, produces delicious fruit of great food value at low cost and with a small labour force.

From the **Official Report** of an Agricultural Department we take the following notes:

"It is confidently believed that date culture is one of the most profitable fruit industries and that it will pay to plant date palms on the best lands employing modern horticultural methods.

The amount of labour and care required by the date palm is much less than that necessary for any other fruit trees. The gathering of the fruit is performed easily and quickly by cutting off a whole bunch at a time.

"The Date Palm is almost as important as a shelter and partial shade for other trees and plants as it is for its own fruit."

We Supply Date Palm Seeds of two varieties at the following prices:

Phoenix D. Sapida, a strong and resisting tree, demands no special care, but yields plenty of nice and soft fruit:

On receipt of 3 Shillings we forward about 10 ounces seeds (in full fruit) as sample of no value, under registered postage paid.

On receipt of £1.-,—Sterling=10 lbs. nett, by parcel post, postage paid.

Phoenix D. Nobilis requires more attention and plenty of heat; it produces a high class fruit of excellent flavour:

On receipt of 3s. 6d. we forward about 10 ounces seeds (in full fruit) as sample of no value, under registered postage paid.

On receipt of £1.5.--Sterling=10 lbs. nett, by parcel post, postage paid.

Prices for quantities on application. Detailed instructions for cultivation with every order.

Never buy Date Seeds in Kernels, as such, i.e., without the pulp; they easily lose the germination power and offer no guarantee that the trees will produce soft dates, for a dry or hard date is absolutely valueless.—We therefore supply date palm seeds only in the original fruit.

GEVEKOHT & WEDEKIND, Hamburg 1.

undergone weathering to clay; *date palms* must have abundant irrigation; *oil palms* grow on all soils, but prefer light sandy ones; sago palms prefer marshy lands. *Tuber and rhizome crops*, many species of which form the staple of the natives' food, thrive best on loose soft, deep, humous soils free from stones. *Bananas* do not like clayey soils, otherwise they grow everywhere, benefiting by organic manuring. *Maize* and *sorghum* have no special requirements, while tobacco prefers soft, warm, deep, humous soils rich in plant food and with sufficient potash.

MANURES.

As for the use of manures, the idea that tropical soils are inexhaustible is now exploded; on the contrary it may be said that they get exhausted easily. In such cases they are manured or left fallow; or they are abandoned for new lands. Which of these methods is to be preferred depends upon the economic conditions, especially the cost of manuring. It is to be considered that manuring has the effect of not only increasing the crops but also ensuring them; and if sometimes, as for instances with tobacco (Havana), it may injure the quality of the crop, it may be said that in general it keeps the plants healthier. But perhaps the most important effect of manuring is that of prolonging the duration of plantations; thus, for instance, whilst coconut palms live usually about 70 years, the use of manure prolongs their productive existence to 80 and 100 years; for coffee, also, a suitable and early manuring may prolong the life of the plantation by 5 or 10 years.

It is to be expected that systematic experimentation, such as the German Colonial Office and the Colonial Section of the German Agricultural Society have already undertaken in the German Colonies, will give the same results

as it has given in Germany. Greater care is, however, necessary in the choice of the manures; thus in the moist tropical regions and especially on ferruginous soils, a deficiency of phosphoric acid is hardly to be feared; potash salts mostly give good results in the regions of abundant rains, whilst potash abounds in the arid belts; in general nitrogenous manures are not to be recommended in the tropics as they are in the temperate zones; lastly, when liming is required it must be done under the form of marl or ground limestone, quicklime being rather too energetic in tropical soils. In a general way it may be said that the colonial farmer must prefer the less easily soluble manures to the more soluble ones; especially in those regions having a high rainfall which easily leaches the soil; thus sulphate of ammonia and Peruvian guano are to be preferred to nitrate of soda; and bone meal to superphosphate, the soluble phosphoric acid of which rapidly retrogrades in red and yellow soils.—MONTHLY BULLETIN.

CURE FOR SNAKE BITE.

In the issue of this Journal for September, 1913, a paragraph was extracted from the QUEENSLAND AGRICULTURAL JOURNAL to the effect that the juice of the stem of the banana plant destroys snake poison.

MR. DONALD OBEYESEKERE, Advocate, of Rajagiriya, Colombo, had a favourite dog of his bitten by a *Cobra de capello*—the well-known hooded cobra, one of the deadliest of snakes. The dog was stung in no less than four places on its tongue and two places on the foreleg and was more or less in a comatose condition with its tongue bloodless. A full-grown plantain tree (Kolikuttu or table variety) was cut down and the juice squeezed out of its trunk and administered—2 breakfast cupfuls. The dog rapidly grew better and within half an hour was able to walk. An hour later it took its usual meal.

MR. OBEYESEKERE in the course of a communication to the daily press writes :—" I have had my bull terriers stung time after time by cobras and have invariably succeeded in bringing them round when they were not stung on their tongues—by administering them lime juice and ghee internally and undiluted Condy's fluid externally after having slit the spots where they have been stung with a pen-knife and squeezed out the dark blood that had accumulated there. Never had I been able to effect a cure when a dog had been stung on its tongue. In this instance too I administered ghee, lime juice and Condy's fluid as usual but the case grew steadily worse."

The subjoined account written by MR. E. G. A. PALMER of Cocagalla goes to indicate that the banana juice is as efficacious on human beings as in the case of animals.

" The subjoined facts may prove of interest to those of your readers who are interested in the use of banana juice as a cure for venemous snake bite. One of the coolies on this estate was bitten by a green "tic" while at work. I heard of the case from the dispenser at about 4 p.m. and lost no time in getting a plantain tree cut down and giving the patient about $\frac{3}{4}$ of a long tumblerful of sap undiluted. The man was comatose at the time and had had Sinhalese people up to charm him. The next morning, after about half a tumblerful more of the sap he was allowed to go to sleep, as there was no swelling of the foot (he had been bitten in the toe) and since then the man has been quite all right again."

MR. R. DE ROOS NORMAN of Tinchur, Cochin State, reported a similar case of cure effected on a cooly bitten by one of the most venemous snakes known in India, by administering the juice of the banana stem.

More recently a case of a European planter being cured by the administration of the juice was reported in the papers by MR. B. F. DE MEL of Villa De Mel, Colombo.

It will interest readers to know that of the many varieties of plantains the ash plantain and the kolikuttu or table are considered the most efficacious preferable.

Commenting on the subject, our contemporary above quoted resumes the subject in the following article which must prove very interesting :—

"We have heard of several infallible cures for snake bite, but many of them are only infallible from the inventor's point of view. Now, a DR. SPEISSIGER has submitted the following prescription which appeared in a Carolina (U. S. A.) Gazette so far back as 1749. It was discovered by a negro slave, and is said to be infallible. As a reward for his discovery he was given his freedom and a pension for life :—

"Take of the roots of plantain or horehound (in summer, roots and branches together) a sufficient quantity ; bruise them in a mortar, squeeze out the juice, of which give as soon as possible one large spoonful. If the person is swelling, it must be forced down the throat. This generally will cure. If the patient finds no relief in an hour after, give another spoonful, which never fails. If the roots are dried, they must be moistened with a little water.

"To the wound may be applied a leaf of good tobacco, moistened with rum. The plantain and horehound roots are easily procured in Queensland. Happily, deaths from snake bite are rare in this State, but it is well to know of even a possible cure. Some districts of Queensland are infested by death adders. Residents in such places should take note of any possible cure, as the strychnine cure may not be always available.

" The plantain here mentioned is the Banana known botanically as *Musa paradisiaca*. What properties the juice of this plant has in common with that of horehound we cannot say, but it seems to be taken for granted that the juice is merely water holding some astringent and, so far as we are aware, no chemist has troubled to analyse it. We heard that only lately, in North Queensland, a cure had been effected by its means. Unfortunately, we could get no reliable information on the case which was said to have emanated from Cairns or Port Douglas. One scientific gentleman, to whom we mentioned the matter, said that absolute proof is necessary of its curative properties ; but who would risk applying it in preference to known remedies ? Very reasonable, but we have travelled in country, especially in New Guinea, where death adders literally swarm, and where no remedies are available, but these plantains abound. If this alleged remedy were there known, would any one hesitate to try it ? One argument against it is that snake poison affects the blood, and that any internal application in the shape of a draught could have no effect on the blood. At all events, experiments could be made on the lower animals, such as cattle, dogs, guinea pigs, or even pigs, which are believed to be immune to snake-bite, and, again, on natives who are frequently bitten by death adders, and have, as far as white men know, no antidotes unless they possibly know of the plantain juice cure. At all events, the subject is worth investigating in countries where snakes abound, especially in India, where thousands of natives die every year from snake bite. 120,800 persons died last year in India from snake bite." J. S. DE S.

JAPANESE LANDSCAPE GARDENS.

The dust and din of the outer world were left behind as the visitors to the tea-garden entered the gate, and waited at the *machiai*, or rest-shed, until their host summoned them. From the *machiai* to the tea-room was the winding *roji*, or garden path, with its orderly but oddly-framed stepping stones, around which clustered dried pine needles. They would touch in passing some hoary moss-covered granite lantern, shaded by a gnarled evergreen tree.

All conduced to serenity of spirit. A great tea-master, Kobori-Enshiu, who lived in the days of Queen Elizabeth, finds the idea of the garden path in the following verses :—

"A cluster of summer trees,
A hint of the sea,
A pale evening moon."

Absolute purity is demanded everywhere. Here is a story :—"Rikin was watching his son Shoan as he swept and dusted the garden path. 'Not clean enough,' said Rikin, when Shoan had finished his task, and bade him try again. After a weary hour the son returned to Rikin and said : 'Father, there is nothing more to be done. The steps have been washed for the third time, the stone lanterns and the trees are well sprinkled with water, moss and lichens are shining with a fresh verdure ; not a twig, not a leaf have I left on the ground.' 'Young fool,' chided the tea-master, 'that is not the way a gravel path should be swept.' Rikin then stepped into the garden, shook a tree and scattered gold and crimson leaves over the path—the wealth of autumn. Rikin demanded not only cleanliness, but also the beautiful and the natural."

Until their arrival in Japan, as a recent writer has remarked very justly, globe-trotters are under the impression that a Japanese garden means a paradise of flowers, outvying the American or European enclosure. Rather is it a paradise of rocks and stones, full of suggestion of remote valleys and hills. Flowering shrubs come in accidentally ; while a blaze of colour could only appear as a background or contrast. The type of tree is that of some quaint evergreen with an individuality of its own, that seems—with its twisted roots and sinewy limbs—to tell of storms weathered successfully.

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Like everything that comes from a Chinese source and retains its original flavour, there is the cult of the old and mature in the arrangement of the garden. It is our English poet BROWNING who speaks of the ideal man as finding truth and reality in the ripeness of his years :—

> "Youth ended, I shall try,
> My gain or loss thereby . . .
> Young all lay in dispute,
> I shall *know*, being old."

Every stone in the garden seems to have a meaning of its own, and the most guileless-looking rock from the river-bed may bear a name like Moon Shadow, Wild Wave or Flying Crane. The garden is an enclosure where perfect proportion reigns, and the eye is suffered to rest only upon what conveys an impression of serenity. Form and tone are everywhere : colour is merely accidental—if it be present. At no time is the Japanese garden more beautiful than by moonlight.

There are three essentials—a stone, a tree, and water or its suggestion. Thus a watercourse may be dry and yet suggest falling water. It is not necessary to have water that may be turned on when required. There is, indeed, a distinct type of garden known as the Kare-Sunsui, where water is not present.

The stone lantern is to be regarded as an ornamental stone, and has a place in every garden, however small. Unlike ninety-nine of every hundred Japanese articles of virtue, the stone lantern cannot be traced to a Korean or Chinese source. The first lantern we read of was erected early in the seventh century of our era by an emperor's son, PRINCE IRUHIKO, who placed it by the side of a lake where some highway robberies had taken place. Its earliest intention was, therefore, of a social kind, to benefit wayfarers. From the highway it found its way to the courts of temples, as a fitting decoration, and elaborate lanterns were presented to shrines by devout worshippers. At Nikko and other Buddhist centres the stone lanterns are crowded together like automobiles in Piccadilly of an afternoon. Among them are many bronze lanterns, and foreigners who have been fortunate in securing one have placed the lantern in the garden ; but it does not properly belong thereto. Hanging lanterns, however, of bronze are often suspended by a chain from the verandah eaves of a house or tea-room, so as to be reflected in the garden basin, and they may be used without incongruity. Porcelain lanterns have been used on occasion, but they do not lend themselves readily to the production of the age—and weather-worn impression so desired in a garden. They are too fragile and ornamental in nature; demanding tracery and pictures of their own.

Lanterns are not much associated with actual lighting ; but natural stones are often so arranged in the vicinity of standard stone lanterns as to lead up to a higher "lamp-lighting stone," often double-stepped. There are, broadly-speaking, four patterns of lantern. First is the pillared lantern, with the roof over the fire-box, usually hexagonal and curved at the extremities of the angles. Perhaps the best known of these pillared stone-lanterns is called the Kasugakatâ. Next comes the broader snow-viewing or Yukimi-kind, with umbrella-like top and spreading feet. Again, there is the bracket form, where there is only one support of the nature of a leg, assuming a curved form, and allowing the fire-box to rest free over a pool. To many the appearance of instability in this form is an objection, but it can be used very effectively.

Lastly, there is the unassuming "Crouching Lantern," with neither pillar, feet, nor bracket. It is placed upon some rude stone near a low water-basin.

The Japanese garden has also room for lamp-posts of wood. These stand on garden roads or in passages, adjacent to summer-houses or resting-sheds. The fire-boxes take a square or wedge-shape, are roofed with boards or thatch, and are carried on high posts.

A garden lake of any size demands its island or islands. These are of two kinds—those that are reached from the shore by stepping-stones or bridge, and those that are out in the open, suggesting islands in the ocean. The chief of the latter kind is the *Horai-jima*, or Elysian Isle, the fairy or Brownie land of Chinese legend. This type is patterned after these fabled isles of the sea, peopled by monsters. The whole island takes the form of a tortoise, emblem of strength and longevity; on its back rests a rugged Pine tree. Stones, carefully selected, furnish the idea of the head, of the four feet, of the tail. There is also the *Fukiage-jima*, or wind-swept island, with the tree branches bending to an imaginary breeze, so as to suggest mid-ocean. No fresh-water vegetation is in place with either of these forms, but a pebbly beach, sea sand and shells.

What is known as the Master's Isle is placed in the foreground of the landscape and is reached by a bridge or a picturesque combination of bridge and stepping-stone. As often a peninsula (*deshima*) as an island, it usually has a resting-shed or rustic harbour for the visitor, as well as a Stone-of-Easy-Rest, set apart as a favourite spot for the master to take his ease. We also expect to see in the Master's Isle a Stone of Amusement (*Yukio-seki*) on a headland convenient for angling.

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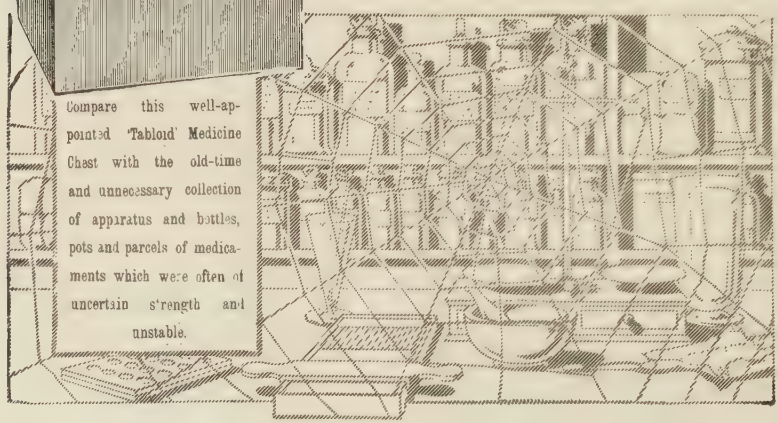

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Very similar to the Master's Isle is the Guest's Isle, which is placed more in the background and is likewise approached by bridge and stepping-stones. Its ornamental stones are chosen to denote hospitality. There is a Guests honouring Stone, which serves as a rest for an important visitor ; an Interviewing Stone, of flat shape, in front of the Stone of Honour, where the host stands to salute visitors ; and Water-fowl Stones for birds to rest upon.

The Master's Isle as well as the Guest's Isle may contain a Seat of Honour Stone, patterned after a sacred stone in India, and a choice old tree always grows beside it. This takes the mind back to the banks of the Niranjara River, when truth flashed upon Guatama's soul. I might also mention the *Yama-jima*, or Mountain Isle, containing two peaks, one somewhat higher than the other. Encircling this island is a stretch of flat beach with occasional rocks.

A well is an indispensable feature of a Japanese garden. While in itself useful, its chief end is often ornamental, helping to express the mood or sentiment of the whole place. The ordinary form contains a border of box-like frame of wood or stone, two buckets suspended on a pulley, one resting on the edge of the frame, the other in the water. The accessories are a drain, stepping stones and ornamental rocks. Sometimes the pulley is of porcelain ; the Oxford frame is popular for the box-frame, the sides being of artistically-grained wooden slabs.

There is a semi-religious sentiment hovering round the presence of water in a Japanese garden, as something pure and immortal, reminding us of the text in St. John's Gospel, iv., 14. "A well of water springing up into eternal life." An ornamental stone water-basin, taking the form of Fuji-yama, maybe, or, in statelier gardens, of a bronze Lotus bowl, is as common as the well. A running-water basin is also popular, the water being allowed to stream over the bowl.

Let me discuss the essentials of garden construction. First comes the necessity of following and encouraging natural lines—assisting Nature, and not forcing her. Keep the geometrical and the artificial far away. Rigidly exact circles or ellipses, or rectangles, or squares—these have no place in a Japanese garden, as they have no place in actual outdoor life. Even the Parthenon, that miracle of architectural beauty, as recently shown by a capable writer, does not deal in straight lines. The apparent straight lines are delicate curves, so shaped as to give at a distance the appearance of forthrightness. And stone, it must be remembered, is not nature-life. Here must I make the exception : garden stone lanterns may always have geometrical curves, angles, and straight lines, for they come into a different category because of the material. The ease and grace of life are for the most part expressed in terms of subtle curves. To find these subtle curves demands both time and sympathy. Secure ease and grace of expression in the garden without the appearance of painstaking effort or studied labour. Here comes in the great principle of *Ars celare artem*, not manifest in the Dutch or Italian garden. The key-note of the Japanese garden is the spontaneity of life, which is Nature's secret that we may wrest from her by minute care and patience. Rich design, the accumulation of ornament, savour of vulgarity. Even one graceful old Pine, with two or three *yamaji*, Chrysanthemums, may make a garden of supreme taste. The garden must be given a soul.

Good taste has the effect of inspiring a feeling of truth and purity, while vulgar taste has a depressing effect. Refined taste in a garden consists not in the extent of its area nor in the profusion of its shrubs and trees, but in the truthfulness of the setting or composition. In arranging the details for a garden it is well first to study the topographical features of the spot where you decide to make it. Then transplant thither the mood or aspect of some vale or stream or hill that is dear to your memory, and arrange, all the single effects to suit the whole design.

Dispense with a fictitious mountain, says one good authority, if there is a fine waterfall. Eliminate a pagoda if there is an arbour. Study reticence, the "something left over," which leaves room for suggestion. A garden without suggestion is no real garden. Be ever careful to transcend artificial rules and enter as far as you can into the real spirit of Nature.—J. M. Dixon in Gardener's Chronicle.

ROWS IN CORN COBS.

REZSO FLEISCHMANN.

In selecting the ears of maize, growers as a rule only take into consideration the pure line and the percentage of cob and grain in relation to the whole ear. There are, however, certain other essential characters which should not be lost sight of. One is the number of rows, which may vary from 8 to 26 or even more in the case of the Horsetooth variety.

The importance of this character is demonstrated by observation on specimens of the above-mentioned variety, selected on the Ruma Estate; these showed that the weight of grain per ear increases regularly with the increase in the number of rows from 8 to 22.

The result was that the ears of 1912 had an average of 3 or 4 rows more than the original material of the first year.

In the number of seed-rows of the ears selected on the Ruma estate, the average of the ancestors varies about the figure 14, and the experimental data relating to the 1912 harvest indicated in Table show that the off-spring revert to this mean.

No. of lines.	No. of rows of grain in parents.	Average No. of rows of grain in the ear of each generation.
Plot No. I.		
13	14	14·04
20	16	14·58
5	18	15·56
2	20	16·23
1	22	17·31
Plot No. II.		
1	12	13·40
9	14	14·21
34	16	14·78
4	18	15·29
1	22	15·94
1	26	17·25
Plot No. III.		
7	12	13·92
24	16	15·01
6	18	15·32
8	20	15·88

According to these data the average number of rows of seeds in the offspring of the many-rowed parent ear is greater than the average of those from the fewer-rowed parent ears, but the average of the first approaches

from nearly the average number of rows of the whole group (i.e., 14) than the number of rows in the parent ear. This character can only be fixed by prolonged and continued selection.

The ears of the high-cropping types had, except in certain cases, the greatest number of seed rows.

The number of seed rows in the ear is also correlated with other characters. With increase in the number of rows the tips of the seeds are narrowed and become elongated, while the percentage of rachis in the ear decreases. The following results were obtained by the writer.

No. of rows	...	8	10	12	14	16	18	20
Percentage of rachis in the ear	...	20·6	16·7	14·4	14·3	15·4	15·3	14·9

These observations show that in the selection of maize or the improvement of the yield considerable importance should be attached to the number of seed-rows. At the same time the other characters must not be lost sight of. Further, the quantity and quality of the seeds, and the structure of the seed, and the structure of the rachis are also important factors in the analysis, a thickened rachis being correlated with a low yield. Also a thick rachis contains more pith, which takes longer to dry and deteriorates quicker, especially during a wet season.—MONTHLY BULLETIN.

IS THE EARTH DRYING UP?

PROF. J. W. GREGORY, D. Sc., F.R.S.

Underlying the irregular and apparently capricious variations of the weather, a regular cycle of change has been recognised by the study of long continued observations. This cycle appears to be only a secondary movement on a still greater cycle, and it, according to some geographers, is in turn controlled by variations the length of which can only be measured in geologic ages, while glacial deserts were being changed into torrid wastes. In recent years we have been often warned that one of these great climatic changes is now carrying the world, slowly and irresistibly, toward world-wide drought. The view that the Earth is becoming steadily and even alarmingly drier was advocated in a paper read to this Society by PRINCE KROPOTKIN in 1904, and a considerable body of evidence appears to support this view.

Thus in recent geological times, glaciers were far larger and more numerous than they are now. Then followed a time characterized by such vast lakes that PRINCE KROPOTKIN has proposed to call it "The Lake Period." Hence, according to him, the world has recently experienced three successive climates, those of the cold Glacial Period, the moist Lake Period, and the existing period of world-wide desiccation. That the Earth is now becoming drier is consistent with many impressive facts. The post-glacial lakes have grown smaller; they have been replaced by marshes, or even by meadows. The great inland sea of south-western Asia has shrunk until it is now represented only by the Caspian and the Sea of Aral. Asiatic travellers bear unanimous testimony that in large areas of Central Asia, lakes and swamps are still disappearing, fertile plains are still being converted into deserts, rivers are ceasing to run, and the deserted ruins of once busy cities are being buried in sand. All these changes are interpreted to mean that the rainfall over central Asia has decreased and is still decreasing.

Similar evidence is reported from many widely spread parts of the world The desolation of Palestine is attributed to a decrease in its water supply. In tropical Africa, many lakes have vanished, and Lake Chad has become so much shallower and smaller that it has been described as "a disappearing lake." LIVINGSTONE's first contribution to South African geography, which was unluckily lost, described the increasing desiccation of the country beside the Kalahari desert. In North America, great freshwater lakes have dwindled to salt pools; Indian cities, once numerous in certain districts, have been deserted, and these districts are said to be incapable of now maintaining a population corresponding to the number of ruined settlements. In South America, DR MORENO (1901, pp. 581, 586) and SIR MARTIN CONWAY (1904) have referred to evidence of cultivation in land now abandoned owing to the failure of the water supply; and BOWMAN (1909) has described recent desiccation in southern Bolivia. The maps of the interior of Australia mark many extensive lakes which are to-day mere clay pans or salt swamps, while the once fertile plains around them have withered into desert.

Many of the geographical changes have been proved by unmistakable evidence, and according to PRINCE KROPOTKIN they occasioned some of the greatest historic movements among men. Thus he attributes the over-throw of the Roman Empire to the dwindling rainfall of Central Asia, which turned whole tribes of agriculturists into nomads by the repeated failure of their crops, and finally drove the drought-stricken barbarians into Europe, owing to their own lands having become uninhabitable. Similarly, PROF. J. L. MYRES (1910, pp. 679-80) has attributed the various invasions of Egypt to droughts in Arabia and Libya. If this desiccation of the Earth is still in progress it must lead to further great political changes; for in time the populations of the world will be forced out of the centres of the continents and crowded into continental margins.

This theory affects so many geographical questions that I gladly accepted the invitation to reconsider the evidence on which it rests, and discuss the conclusions which can be founded on the facts.

THREE FORMS OF THE DESICCATION THEORY.

The theory that the climate of the world is becoming drier has been advanced in three main forms. As promulgated by PRINCE KROPOTKIN, the climate is undergoing a steady progress towards drought, though there may be fluctuations in the advance.

PROF. ELLSWORTH HUNTINGTON formerly adopted the theory in this form; but in recent years he has modified it, and now regards the most conspicuous change as pulsatory, causing an alternation of wet and dry periods; and he considers the differences between them to have been sufficient to have very important political and economic results, the dry periods having been sufficiently arid to render vast areas uninhabitable and to effect the moral ruin or extinction of whole nations. Although he recognises repeated returns towards moister conditions, he agrees with PRINCE KROPOTKIN that the resultant tendency of the present climatic movement is towards greater aridity. "At certain periods the climate appears to have become rapidly drier. At others it became moister, but, on the whole, the general tendency has been from moist to dry, and possibly from cool to warm. Thus it appears that the climate of the present time is distinctly drier than that of two thousand years ago. Nevertheless, at certain times during the two thousand years conditions appear to have been even drier than at present" (HUNTINGTON, 1910, p. 665).

A third form of the theory represents the climate as varying in great cycles, each of which may take thousands of years to run its course. Thus MR. ROWLAND THIRLMERE (1905, pp. 595 599) holds that our spring and summer "grow shorter and colder year by year. The apricot tree, now slowly

but surely disappearing from Central Europe, is a proof of some great climatic change inexorably approaching. Up to 1250 A.D., our temperatures were getting higher every year, but since that season of maximum heat the European springs and summers have been getting gradually colder. Chillier still they must become until the period of maximum cold is reached, probably about the year 2300 A. D." (THIRLMERE, 1905, pp. 594-5). He quotes figures which he claims to prove that the world is moving forward to one of the great turning-points of seasonal change. "We Europeans," he says, "are almost imperceptibly hastening towards a minimum of spring and summer brightness. Before four hundred years have passed, there will be no wine made in Champagne, and the grape-wine will not exist in that part of France, nor in Burgundy, nor in the Gironde. The vintages of Medoc and Macon will have become historical. Provence will be the only district producing wines north of the Pyrenees. Andalucia and the Mediterranean coasts of Spain will still make the red and yellow liquors for which they are now renowned. But the vineyard countries *par excellence* will then be Algeria, Morocco, and possibly Australia. Within ten thousand years Madrid, if she still exists, will have the winter temperature of Paris, Paris that of Berlin, and Berlin, that of Stockholm" (THIRLMERE, 1905, pp. 598-599).

PALESTINE A TEST CASE.

A more precise test is needed than the variation of lakes and the ruin of cultivated land by wind-blown deposits. Probably the best available test is supplied by vegetation, and especially by any changes that may have taken place in the range of food plants or fruit trees in the countries of which we have the longest written records. Palestine furnishes a very good test case of such a nature.

EVIDENCE OF DESICCATION.

The striking contrast between the present and past conditions of Palestine appears at first to indicate some fundamental change in geographical conditions. Palestine is described in the Bible as a land flowing with milk and honey; it was fertile in vine and olive; many incidents suggest that it was well wooded; and, according to the Old Testament statistics, it had a dense population. Now it is a barren, arid land, with a scanty vegetation, swept by parching winds from the Eastern deserts, and occupied by some 700,000 people, who are mostly Arabs and most by paupers; and towns with only a tithe of their ancient population are said to be at the very limit of the available water supply.

ANCIENT POPULATION.

This deplorable change, according to one explanation is due to mal-administration and the blighting presence of the Turk; and it is held that under better government the country could be restored to its ancient fertility and prosperity. But, according to an alternative view, Palestine has been paralyzed by a climatic change; and this second explanation is affirmed on many grounds. It is claimed that the ruins of the ancient cities indicate that they had a population far larger than could be supported by the present water supply. Thus the population of Gerasa, the ancient of Jerash, in the land of Gilead, has been described by PROF. ELLSWORTH HUNTINGTON (1911,p.279) as insignificant in comparison with that of the ancient city; and yet holds that the water supply available only just suffices for the present inhabitants (1911, pp. 278-282). The same author quotes the opinion of PROF. H. C. BUTLER of Princeton, that the ancient ruins indicate that some districts of Syria had a far larger population than they could now support. According to the Book of Numbers (i. 3 and 46), the Israelites in the wilderness included 603,550 men capable of bearing arms; the census in the reign of David records the number of available warriors as 1,300,000 (2 Sam. XXIV, 9),* and the total

* The number in 1 Chron. xxi. 5, for the same census, is given as 1, 570,000 ; Josephus adopts the smaller total, though differing in the numbers assigned to the two kingdoms.

population then has been estimated as from five to six millions; and if Josephus be correct in his statement that 1,100,000 of the inhabitants of Jerusalem perished during the siege by Titus, the population of the city must have been as prodigious as overcrowded. It would certainly be difficult to maintain in modern Palestine the population indicated by these records.

WOODS AND RAINFALL.

Changed climatic conditions are also inferred from the forests. Palestine is represented as having been, in Old Testament times, a well-wooded country. Joshua (xvii. 15 and 18) promised the Ephraimites that "the mountain shall be thine; for it is a wood, and thou shalt cut it down;" and the "wood of Ephraim" is often referred to in Bible history; and the fact that timber was used in ancient buildings in districts where none grows now is quoted as evidence of the former greater abundance of forests.

ANCIENT CLIMATE AND WATER SUPPLY.

Another argument is afforded by the difference in the caravan routes into Palestine. Thus according to PROF. HUNTINGTON (1911, p. 269) three thousand years ago a great trade was conducted over the road from Egypt to Palestine, and it is now commercially useless owing to lack of water.

More direct evidence is offered by the former higher level and quarter size of the Dead Sea. Many ancient terraces mark the former positions of its shore. One of the most noticeable of the old beaches stands about 250 feet above the present surface of the water; this beach, however, was formed some five to six thousand years ago, so that it is prehistoric; but from the position of the boundary between the tribes of Benjamin and Judah, PROF. HUNTINGTON claims (1911, pp. 311-313) that in the time of Joshua the Dead sea level stood higher than it does now. The level is said to have been higher also in the time of Christ, though it was admittedly as at present in 333 A.D. Hence, there does not appear to have been any serious progressive fall in the surface of the lake since the time of Joshua, though there have been periods of rise and fall due to temporary variations in the rainfall.

PROF. HUNTINGTON concludes (1911, p. 375), "All these facts, and others not here mentioned, make a strong case in favour of the theory that from about 1100 B.C. or a little later, down to the time of Christ, comparatively moist conditions prevailed most of the time."

From such considerations many authorities have adopted the view that there has been a material change in the climate of Palestine since Old Testament times. This conclusion is advocated by PROF. E. HULL, PROF. O. FRAAS, Dr. T. H. FISCHER in his well known memoir on the climate of the Mediterranean lands, FR. R. P. ZUMOFFEN, PROF. HUNTINGTON, and by others. Observersin adjacent lands have supported this view, such as MR. D. CARRUTHERS in Arabia and PROF. J. J. MYRES in Egypt.

FORMER POPULATION EXAGGERATED.

Nevertheless the evidence seems unconvincing. The estimates of the former population are probably greatly exaggerated. HILDERSCHEID has rejected the estimates in the time of Moses and David (HILDERSCHEID, 1902, p 98); and so does DR. STEVENSON, Professor of Hebrew in Glasgow University, in the following answer to an inquiry as to the probable ancient population of Palestine:—

"The literature of the Old Testament itself does not seem to contain numerical estimate of the population of Palestine in Old Testament times. Such numbers as those in Judges iv. 10; xx. 2; or 2 Sam. xxiv. 9, have no claim to be regarded as the result of calculation or estimate of any kind. The numbers of those carried into exile by the Babylonians (as given in 2 Kings xxiv. 14 and Jeremiah lii. 28-30) may be, or may have been originally, correctly recorded, but their relation to the whole population of Judah is a matter of complete uncertainty. A round number of considerable historical

value may be obtained from the statement in 2 Kings xv 19. A poll-tax of fifty shekels produces one thousand talents (reckoning three thousand shekels equal to one talent) when levied on sixty-thousand men. The Hebrew historian, accordingly, assumes that there were sixty-thousand *gibbore havil* in the northern kingdom at this period (eighth century B. C.)

Unfortunately the exact status of the *gibbore havil* is unknown. They may be spoken of as citizens or burgesses, but it is more than doubtful if they were equivalent to the free population capable of bearing arms.

Of the data contained in the inscriptions of the Assyrian kings, the most important, meantime, is one of Sennacherib, according to which the population of the kingdom of Judah, exclusive of the inhabitants of Jerusalem, is apparently given as 200,150 people of all ages (end of the eighth century B. C.). Such a figure is not, however, to be implicitly relied on without confirmation. The same king states that there were forty-six walled cities in Judah, and possibly a calculation may be based on this statement when the average areas of these towns has been sufficiently determined by the excavations now in progress. After the final conquest of the northern kingdom (721 B. C.) KING SARGON declares that he carried off 27,290 captives. But previous to this the kingdom had been reduced to small dimensions, and the proportion left behind can only be guessed at."

Josephus' statement about the population at the time of the great siege is obviously ridiculous.* If 1,100,000 people perished during the siege, the population cannot have been less than 1,200,000; whereas WILLIAM SMITH'S 'Dictionary of the Bible' estimates that the population then "cannot have exceeded 60,000, or 70,000;" and as, according to the same authority, the Roman army "consisted of four legions and some auxiliaries—at the outside 30,000 men" (W. SMITH, 1860; *op. cit.*, pp. 1011—12), it could hardly have besieged a city of a million desperate people. From the area of Jerusalem and the estimate that in Eastern cities the population is never more than 1 to 50 square yards, SMITH calculated that the population of Jerusalem could hardly have reached 20,000, and probably (SMITH, 1860, p. 1025), even in the days of its greatest prosperity, included only 30,000 to 45,000 souls.

SCARCITY OF FOREST.

The arguments based upon the former woods and forests of Palestine is of little value, for the term translated "wood and forest" may have meant only scrub. Principal GEORGE ADAM SMITH tells us "the Hebrew word we translate *forest* ought to be *woodland*, and perhaps only *copse* or *jungle*, and we may safely conclude that the land was never very much more wooded than it is to-day. The distribution of woodland may have been different, but the woods were what we find the characteristic Palestine wood still to be—open and scattered, the trees distinguished rather for thickness than height, and little undergrowth when compared with either a northern or a tropical forest. Here and there groves of larger trees, or solitary giants of their kind, may have stood conspicuous on the bare landscape" (G. A. SMITH, 1897, pp. 80—81. See also HILDERSCHEID, 1902, p. 100). The general statements in the Old Testament are fully consistent with the conclusions of Principal G. A. SMITH and DR. HILDERSCHEID; for though we hear much of the cedars of Lebanon and the oaks of Bashon (Isa. ii. 13), very little useful timber appeared to grow in Palestine itself. The wood for the temple was imported from Labanon. No doubt in many places there is less vegetation than formerly; for woods are said to have disappeared since the time of the Crusades; but this is not likely to be a climatic effect since, in some places,

* His figures are scornfully rejected by BELOCH, 1886, p. 246.

the woods have actually increased; for Principal G. A. SMITH tells us (1897, p. 80), "On the other hand, copse and wood cover many old clearings, as on Carmel."

UNCHANGED RAINFALL.

An extensive deforestation of Palestine has often been adduced as the cause of a reduction of the rainfall; but any appreciable change in the rainfall is quite unproved. Palestine now has a moderate rainfall. The average for Jerusalem for a mean of forty-seven years (1860—1906) is 26 inches; so that Palestine has a heavier rainfall than Essex, and there is no adequate evidence that it has been larger at any time since the days of the Patriarchs. Thus HILDERSCHEID concludes (1902, p. 103) that, "referring to the conditions of rainfall in Palestine in ancient times, as presented to us by the Bible and the Talmud, and comparing the same with the present conditions of rainfall in the Holy Land, no important reduction of the rain in subsequent time is established."

Principal GEORGE ADAM SMITH is equally emphatic. "Did the rain in ancient times differ from this? The Old Testament data are, of course, not specific, but at least sufficient to justify a negative answer. Some authorities on the climate and fertility of Palestine have, indeed, argued that as in the Mediterranean basin as a whole, so throughout Palestine in particular, the climate has suffered a change for the worse through the diminution of the rainfall. One of the reasons given for this conclusion is the alleged decrease of the woodlands of the country. I have elsewhere shown that in all probability these were never much greater on western Palestine than they are to-day. The other natural features by which the rainfall is influenced—the position of the city relatively to the sea, and the prevalent winds—have remained the same; while the references to climate and weather in the Bible and Mishnah are fully consistent with the present conditions. We may conclude, therefore, that the rainfall upon Jerusalem in ancient times must have been very nearly the same as it has been observed to be during the last forty-six years. Even if it was a little greater, the difference cannot have been of much practical moment" (G. A. SMITH, 1907, p. 78). The unaltered nature of the rainfall is also maintained by WATT from a study of records at Hebron (1903, pp. 134, 147*).

Moreover the distribution of the rainfall during the year appears to have remained the same. Practically all the rain now falls in the winter months, and only 2½ per cent. falls in the six months, from May to October; and that rain was very exceptional in the summer is indicated from the comparison in Proverbs (xxvi. 1). "as snow in summer and rain in harvest," and the statement in the Song of Solomon (ii.11.), "winter is past, the rain is over and gone."

It has been claimed that a statement in the Mishnah, the earliest of the Talmudic books, indicates that about 200 A.D. the rains began a month earlier than they do now; for a three-days' fast was ordered, if no rain had fallen by a date, the limits of which are between October 22 and November 21. According to the authorities cited by KEELING (1909, p. 87), the date would fall, on an average, on November 7, and the rains now often begin by the middle of October. HUNTINGTON (1911, p. 421), in his summary of the dates for the beginning of the rains in Jerusalem, shows that during fifty-nine years for which records are available, the important rains began twenty-four times in October, twenty-seven times in November, seven times in December, and

* MR. WATT says, "It is unquestionably true that the weather lore of the Biblical writings is in every way applicable to the average weather conditions of to-day—WATT, 1903, p. 147).

once in January.* Hence the fact that the Jewish farmer became seriously anxious if no rain had fallen by November 7, suggests that there has been no change either in the habits of the rain or of the farmers.

A translation of the passage in the Mishnah has been published by KEELING (1900, p. 87), and he does not regard it as any evidence of a climatic change. PROF. G. HELLMANN of Berlin has also referred to the evidence of the Mishnah and concludes (1908, p. 226), from the evidence of that authority, "that the amount of rainfall then considered as normal for a good crop corresponds pretty closely with that deduced from the modern observations made by MR. THOMAS CHAPLIN at Jerusalem whence it can be inferred that the climate of Palestine has not changed."

CONDER (1876, pp. 122, 123), who had called attention to the statement in the Mishnah, concludes in spite of it that "the seasons are unchanged," and PROF. HUNTINGTON (1911, p. 422) dismisses it as so indefinite that no argument can be based on it either for or against any change in the date of the rains. The utmost that could be inferred is that, about 200 A.D., the rains may have begun a little earlier than they do now.

UNCHANGED CLIMATE.

The evidence of the Bible shows that even in the days of the Patriarchs Palestine had a very similar climate to that of the present time. Throughout Bible history, the country was periodically stricken by drought, and the frequent scarcity of water is indicated by many Bible incidents, such as Abraham's gift to Hagar of a bottle of water and her trouble after its exhaustion. Abraham's quarrel with Abimelech was over a well (Gen. xxi. 25). Famines drove Abraham to Egypt (Gen. xii. 10)) and Isaac coastwards into Philistia (Gen. xxvi. 1), and led to the immigration of Jacob and his family into Egypt and of Ruth's father-in-law into Moab (Ruth i. 1). Later on, in the time of the Kings, famines were also frequent. During the reign of Ahab there was no rain for three years (1 Kings xviii. 1)) and the brook beside which Elijah was fed by the ravens dried up because there had been no rain in the land (1 Kings xvii, 7). Great care was clearly taken of the water supply, and that the houses had large tanks, as they still have in Jerusalem, is shown from the incident of Jeremiah in the waterless but miry cistern of Malchiah (Jer. xxxviii. 6); and that every house in town or country had its cistern is implied in the exhortation of Rabshakeh, "Eat ye every one of his vine, and every one of his fig tree, and drink ye every one the waters of his own cistern" (Isa. xxxvi. 16). In Palestine, then, for water during the summer, people were anciently as dependent upon the winter store as they are to this day.

Further, so far as we can judge of the climate from the Bible statements, it appears to have been essentially similar to that of the present time. Many of the prophets give graphic descriptions of the drought-stricken character of the country. "The beasts of the field," says Joel (i. 20), "cry also unto thee; for the rivers of water are dried up, and the fire hath devoured the pastures of the wilderness;" and Jeremiah's warning (Jer. iv., 11-12), "At that time shall it be said to this people and to Jerusalem, "A dry wind of the high places and of the desert toward the daughter of my people, not to fan, nor to cleanse, even a full wind from those places shall come unto me," suggests that the dry desert winds gave Jeremiah as just cause for lamentation as they give to modern visitors.

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* According to ZUMOFFEN (1899, p. 356), the meteorological records at Jerusalem for thirty-six years, from 1861 to 1896, show that October has a mean of 1·2 rainy days and November 6·1; hence the beginning of the rains in October was a normal occurrence. ROBINSON (1841, vol. ii, p. 97) says that the autumnal rains "usually commence in the latter half of October or beginning of November."

The balance of expert opinion seems strongly in favour of the climate of Palestine having undergone no important modification during historic times PHUS ANKEL concludes (1877, p. 123), "The question whether the climate of the lands west of the Jordan has been essentially changed since historic memory, we must answer with a negative:" and he attributes the changes in its condition to political causes and believes with human help, "it could become as formerly, a land full of milk and honey, could again be of higher consequence to the civilized world, and present the same bloom as in the days of David and Solomon" (ANKEL, 1877, p. 129).

LIEUT. CONDER, with the intimate acquaintance of Palestine gained during his prolonged survey, after a careful discussion of "The Fertility of Ancient Palestine," denies that there has been a change in the climate, the seasons, the vegetation, or water supply. He decides (1876, p. 132):—

"The seasons in Palestine are unchanged, and there is no evidence of any very remarkable falling off in the amount of rain, though the data are not sufficient for a definite conclusion on the subject.

"The spontaneous growth resembles in character that mentioned in the Bible. In some districts it has greatly decreased, in others it has spread; woods of timber trees have increased in extent, but still exist in part of the districts formerly occupied by them.

"The present water supply answers exactly to that described in the Bible, in the Talmud, and in Josephus, and depends entirely on geological formation.

"To sum up, the change in Palestine is one of *degree only and not of kind*. The curse of the country is bad government and oppression. Justice and security of person and property once established, Palestine would become once more a land of corn, vines and olives rivalling in fertility and wealth its ancient condition, as deduced from careful study of such notices as remain to us in the Bible and in the later Jewish writings."

As a more recent authority may be quoted, PROF. I. BENZINGER, Professor of Old Testament Exegesis in the University of Berlin. In the article on Palestine in the Jewish Encyclopædia (vol. ix., 1905, p. 497) he emphatically rejects the view that there has been any change of climate in Palestine during the historic period. "All the references of the Old Testament which bear on this question apply," he says, "exactly to modern climatic conditions, and even if there were then more forests than at present, as is frequently asserted, this could not have been the case to an extent great enough materially to influence the climate."

Again, PROF. A. H. SAYCE, in his work on "Patriarchal Palestine," states (1895, pp. 19, 30), that in the time of the patriarchs the country was not well wooded, forest trees were scarce south of the Lebanon, the palm grew only on the sea-coast and in the valley of the Jordan, the tamarisk and sycamore were hardly more than shrubs, and the amount of ground fit for cultivation was no larger than it is now: and he tells us that in Samaria and Judah "The want of water was the only difficulty; in most cases the people were dependent on rainwater, which they preserved in cisterns cut out of rock."

No doubt there had been fluctuations of good seasons and of bad all through the history of Palestine. Famines occurred in the time of the Patriarchs and drove them into Egypt just as they drive the present inhabitants into beggary; but the changes from year to year and from decade to decade appear to be now of the same extent of those of ancient times. Certainly the modern rainfall records give no indication of a failure of rain as complete as in the time of Ahab.

EVIDENCE OF DATE PALM AND VINE.

Nevertheless some more certain test is necessary than the general conclusions which can be based upon the historical and geographical evidence of the Bible. In the absence of rain gauge and thermometric records, the most precise test of climate is given by the vegetation ; and fortunately the date palm affords a very delicate test of the past climate of Palestine and the Eastern Mediterranean. This argument was first used by the Danish botanist and meteorologist, J. F. SCHOUW, in 1826 : it has been extended by various authors, such as the astronomer ARAGO (1833), Principal J. D. FORBES of St. Andrews in 1862, and D. EGINITIS, Director of the Athens Observatory, in 1898. The date palm has three limits of growth which are determined by temperature ; thus it does not reach full maturity or produce ripe fruit of good quality below the mean annual temperature of 69° F. The isothermal of 69° crosses Southern Algeria near Biskra ; it touches the northern coast of Cyrenaica near Derna and passes Egypt near the mouth of the Nile, and then bends northward along the coastlands of Palestine.

To the north of this line the date palm grows and produces fruit, which only ripens occasionally, and its quality deteriorates as the temperature falls below 69°. Between the isotherms of 68° and 64°, limits which include northern Algeria, most of Sicily, Malta, the southern parts of Greece and northern Syria, the dates produced are so unripe that they are not edible. In the next cooler zone, north of the isotherm of 62°, which enters Europe in south-western Portugal, passes through Sardinia, enters Italy near Naples, crosses northern Greece and Asia Minor to the east of Smyrna, the date palm is grown only for its foliage, since it does not fruit.

Hence at Benghazi, on the north African coast, the date palm is fertile, but produces fruit of poor quality ; in Sicily and at Algiers the fruit ripens occasionally, and at Rome and at Nice the palm is only grown as an ornamental tree.

The date palm therefore affords a test of variations in mean annual temperature of three grades between 62° and 69°.

This test shows that the mean annual temperature of Palestine has not altered since Old Testament times. The palm tree now grows dates on the coast of Palestine, and in the deep depression around the Dead Sea ; but it does not produce fruit on the highlands of Judæa. Its distribution in ancient times, as far as we can judge from the Bible, was exactly the same. It grew at "Jericho, the city of palm trees" (Deut. xxxiv. 3 and 2 Chron. xxviii. 15), and at Engeddi on the western shore of the Dead sea (2 Chron. xx., 2, Eccls. xxiv. 14) ; and though the palm does not still live at Jericho—the last apparently died in 1838*—their disappearance must be due to neglect, for the only climatic change that would explain it would be an increase in cold or moisture. In olden times the date palm certainly grew on the highlands of Palestine ; but apparently it never produced fruit there, for the Bible references to the palm are to its beauty and erect growth : "the righteous shall flourish like the palm" (Ps. xcii. 12) ; "they are upright as the palm tree" (Jer. x. 5): "thy stature is like to a palm tree" (Cant. vii. 7). It is used as a symbol of victory (Rev. vii. 9), but never praised as a source of food.†

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*STANLEY, 1856, p. 301, also pp. 143-145.

†ZUMOFFEN (1899, pp. 483-8) holds that the palms must have fruited in Palestine, as some Hebrew coins represent them covered with fruit ; but the evidence of the coins would appear to be inadequate in face of the negative evidence of the Bible, and ZUMOFFEN'S excellent statement of the arguments in favour of a climatic change in Palestine does not appear convincing.

Dates are not once referred to in the text of the Bible, but according to the marginal notes the word translated "honey" in 2 Chron. xxxi. 5 may mean dates PROF. STEVENSON tells me that "the word is rightly translated ,honey' adn is the ordinary word for honey. I do not know how the alternative 'dates' comes to be given in the margin—it cannot rest on any authority. The Hebrew word very possibly denoted not only honey, but a kind of fruit syrup; but that has, of course, no bearing on your question." The Revised Version omits the marginal "dates."

It appears therefore that the date palm had essentially the same distribution in Palestine in Old Testament times as it has now; and hence we may infer that the mean temperature was then the same as now. If the climate had been moister and cooler, the date could not have flourished at Jericho. If it had been warmer the palms would have grown freely at higher levels and Jericho would not have held its distinction as the city of palm trees.

The vine too confirms the view that the climate of the highlands of Palestine has not changed; for the vine does not grow south of the mean isotherm of 72°, unless it be artificially shaded and protected. Vines and olives were the two most characteristic products of the highlands of Palestine. They were widespread: "Eat ye every man of his own vine" (2 Kings xviii. 31). Its fruitfulness was proverbial. "A fruitful vine" is the Psalmist's simile (Ps. cxxviii. 3); "the vine shall give her fruit," promised the prophet (Zech. vii. 12); and the twelve spies sent by Moses returned with bunches of grapes as evidence of the fertility of the promised land. In truth, so common was the vine that it passed into a proverbial expression: "and Judah and Israel dwelt safely every man under his vine from Dan to Beersheba in the days of Solomon" (1 Kings iv. 25).

The evidence of the vine supplements that of the date; for then as now Palestine was on the extreme southern edge of vine cultivation. The vine can be grown in Egypt as at Cairo, but it does not flourish there, and requires to be kept cool, shaded and moist. Its success at Engedi (Song of Sol. i 14) was probably due to the same care.

In accordance with the evidence of the vegetation, ARAGO (1833, p. 204) expressed his conviction that "the mean temperature of Palestine does not appear to have changed since the time of Moses." JAS. D. FORBES concluded, "Hence the climate of Palestine, being neither sensibly hotter nor colder than it anciently was, is, of course, unchanged; and the direct evidence of modern travellers on the distribution of the vine and palm in that country leads to the same result" (1862, p. 179). SCHOUW ends his discussion of the botanical evidence with the verdict "that the climate in Greece and Italy, like that of Palestine and Egypt, has undergone no important change since ancient times. But if, on account of the later harvest and the possible growth of the beech trees in the Roman plains,* we might be led to the opinion that formerly the climate had been a little colder than now, the difference will hardly come up to one or two degrees, and will not be greater than might be occasioned by the cultivation of the north of Europe" (SCHOUW, 1828, p. 324).

The failure of the palm to fruit and the luxuriant growth of the vine on the highlands of Judæa both indicate that the climate there in ancient times was neither hotter nor colder than it is now. In ancient and modern times Palestine was on the southern margin of the cultivation of the vine and was just skirted by the northern margin of the date. Hence there can have been no change in the climate of any practical importance, since the days of the Patriarchs and of the Jewish kings.—THE GEOGRAPHICAL JOURNAL.

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* ARAGO (1833, p. 221) has also considered the evidence that the beech formerly grew on the plains near Rome, where the climate is now too warm for it; but he considers that this evidence must be disregarded, as it is inconsistent with so much else.

DEVICES FOR ASSISTING FRUIT PRODUCTION.

The QUEENSLAND AGRICULTURAL JOURNAL for February last describes a process which has been found successful in influencing the setting of fruit in oranges.

This consists in tying a piece of soft No. 10 wire round the trunk of the tree in the spring, using heat if necessary to make the wire pliable and tapping it to make it follow closely the irregularities of the surface and then twitching it tight. The girdle should be left till the setting of the fruit is assured and then removed. It is most important that a complete girdle should be formed to be of any use. The adoption of this practice by MR. KETEKAR, Manager of the Fairview Orangery, is reported to have given excellent results.

MR. ROSS, Instructor in Fruit culture, Queensland, prefers the practice of cincturing to that of girdling and recommends that it should be performed in the head of the tree instead of on the main stem, as being less drastic. Cincturing is a modified form of ring-barking and consists of the removal of a strip of bark from the circle of the tree. The principle involved is to check the descending sap without unduly retarding the upward flow.

In this connection we may mention that MR. F. H. DANIEL who has given much attention to fruit-growing has succeeded in inducing backward trees to fruit by making vertical cuts down the stem with the object of "loosening" the bark.

Ceylon Agricultural Society.

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Mangalore ,,	Med Brown to good bold	5/3 a 6/6
Ceylon, Mysore ,,	Small fair to fine plump	4/3 a 6/
Malabar ,,	Fair to good	3/6 a 3/8
Seeds, E. I & Ceylon ,,	Fair to good	4/7 a 4/8
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	Red to good	73/ a 80/6
Native Estate ,,	Ordinary to red	42/ a 68/
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COLOMBO ROOT ,,	Middling to good	12/ 6a 21/
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CUBEBS ,, ,,	Ord. stalky to good	130/ a 150/
GINGER, Bengal, rough ,,	Fair	19/
Calicut, Cut A ,,	Medium to fine bold	60/ a 75/
B & C ,,	Small and medium	36/ a 60/
Cochin, Rough ,,	Common to fine bold	22/6 a 30/
	Small and D's	22/6
Japan ,,	Unsplit	23/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	40/s a 72s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,, ,, ,, little red		£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10/
,,	Med. and bold glassy sorts	£5 a £7
Madagascar ,,	Fair to good palish	£4 a £8
,, ,, red		£4 a £7
ARABIC, E. I. & Aden ,,	Ordinary to good pale	26/ a 30/
Turkey sorts ,,		32/ a 55/
Ghatti ,,	Sorts to fine pale	18/6 a 30/ nom.
Kurrachee ,,	Reddish to good pale	25 a 30s nom.
Madras ,,	Dark to fine pale	22/6 a 29/6 nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£7 a £8
	com. stony to good block	40s a £5 12/6
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	60/ a 70/
Somali ,,	,, ,,	52s 6d a 57s 6d
OLIBANUM, drop ,,	Good to fine white	45s a 50s
,,	Middling to fair	35s a 40s
pickings ,,	Low to good pale	15/ a 27/6
siftings ,,	Slightly foul to fine	18 s a 27s
INDIA RUBBER lb.	Fine Para smoked & sheets	2/4¾
	Crepe ordinary to fine	2/4¼
Ceylon, Straits, ,,	Fine Block	2/4
Malay Straits, etc. ,,	Scrap fair to fine	1/10 a 1/11
Assam ,,	Plantation	1/11
,,	Fair 11 to ord. red No. 1.	1/6 a 1/7
Rangoon ,,	,, ,, ,, ,,	1/3 a 1/5

	QUALITY.	QUOTATIONS.
INDIARUBBER lb.		
Borneo ,,	Common to good	9d a 1/3
Java ,,	Good to fine red	1/4 a 1/6
Penang ,,	Low white to prime red	9 d a 1/4
Mozambique ,,	Fair to fine red ball	1/10 a 2/3
,,	Sausage, fair to good	1/9 a 2/2
Nyassaland ,,	Fair to fine ball	1/9 a 2/1
Madagascar ,,	Fr to fine pinky & white	1/6 a 1/8
,,	Majunga & blk coated	1/ a 1/3
,,	Niggers, low to good	6d a 1/6
New Guinea ,,	Ordinary to fine ball	1/4 a 1/7
INDIGO, E I. Bengal ,,	Shipping mid to gd. violet	3s 3d a 3s 8d
,,	Consuming mid. to gd.	2s 9d a 3s 2d
,,	Ordinary to middling	2s 4d a 2s 9d
,,	Mid. to good Kurpah	1s 11d a 2s 5d
,,	Low to ordinary	1s 6d a 1s 9d
,,	Mid. to fine Madras	1/11 a 2/9
MACE, Bombay & Penang	Pale reddish to fine	2/4 a 2/6
per lb	Ordinary to fair	2/ a 2/2
Java	,, ,, good pale	2/ 1a 2/4
Bombay	Wild	1/
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57 s	9½d a 10½d
	80's	7½d
	110's	6½d
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20/
NUX VOMICA, Cochin	Ordinary to good	11/ a 13/
per cwt. Bengal	,, ,,	9/6
Madras	,, ,,	9/6 a 10/
OIL OF ANISEED lb.	Fair merchantable	6/
CASSIA ,,	According to analysis	2/11 a 33/
LEMONGRASS oz.	Good flavour & colour	2½d
NUTMEG ,,	Dingy to white	1½d a 1⅜d
CINNAMON ,,	Ordinary to fair sweet	3½d a 1s 5d
CITRONELLE lb.	Bright & good flavour	1/7¼
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	15/
Madagascar ,,	Fair	15/
Zanzibar ,,	Fair	15/
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	5½d a 5¾d
Ceylon ,, ,,	Fair to fine bold heavy	5⅝d a 5⅞d
Singapore ...	Fair	5d
Acheen & W. C. Penang	Dull to fine	5d a 5½d
(White) Singapore ,,	Fair to fine	8⅝d a8¾d
Siam ,,	Fair	8⅜d
Penang ,,	Fair	7⅜d
Muntok ,,	Fair	9⅛d
RHUBARB, Shenzi ,,	Ordinary to good	2/ a 3/6
Canton ,,	Ordinary to good	1/10 a 3/6
High Dried,,	Fair to fine flat	11/ a 1/1
	Dark to fair round	9 d a 11d
SAGO, PEARL, large--cwt	Fair to fine	18/
medium ..	,, ,,	17/
small ..	,, ,,	13/ a 14/
Flour ..	Good pinky to white	10 a 11/
SEEDLAC cwt.	Ordinary to gd. soluble	65/ a 80/
SENNA, Tinnevelly lb.	Good to fine bold green	5d a 8½d
	Fair greenish	3d a 4½d
	Common specky & small	1¼ d a 2½d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	100/ a £ 7 nom.
Bombay ,,	,, ,,	60/ a £7 nom
Mergui ,,	Chicken to bold	£10 a £14
Manilla ,,	Fair to good	£9 a £14 2/6
Banda ,,	Sorts	82 6
Green Snail,,	Small to large	57/6 a 85/
Japan Ear ,,	Trimmed selected small to bold	41/ a £6 10/
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	14/ a 15/
per cwt. Madras	Inferior to good	6/ a 10/
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold	13/6 a 26/
	Pickings	7/ a 15/6
TURMERIC, Bengal cwt.	Fair	11/6
Madras ,,	Finger fair to fine bold	14/6 a 16/6
Do. ,,	Bulbs ,, ,, [bright	12/ a 13/
Cochin ,,	Finger fair	14/ nom
	Bulbs ,,	12/
VANILLOES— lb.		
Mauritius ... } 1sts	Gd. crystallized 3½a 8½a in.	10/ a 15/
Madagascar ... } 2nds.	Foxy & reddish 3½a ,,	9/6 a 12/
Seychelles ... } 3rds.	Lean and inferior	9/ a 10/
VERMILLION ... lbs.	Fine, pure, bright	2/8
WAX, Japan squares cwt.	Good white hard	55/

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THE CANNON-BALL TREE IN PERADENIYA GARDENS

(*See page 342*)